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Resources

FLOODPLAIN MANAGEMENT STUDY

CROSSVILLE

WHITE COUNTY

ILLINOIS

JUNE 1984

CROSSVILLE FLOOD PLAIN MANAGEMENT STUDY

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FLOODPLAIN MANAGEMENT STUDY

CROSSVILLE, ILLINOIS

WHITE COUNTY

INTRODUCTION

This report defines the flood characteristics of Elliott Creek and its tributaries in and around the Village of Crossville, White County, Illinois. It was prepared for use by local officials in planning and regulation of floodplains. Defining the flood hazard of existing structures provides a suitable basis for regulations to guide floodplain development without increasing potential for flood losses. Also listed are existing structures in relation to the 10 percent, 1 percent, and 0.2 percent chance recurrent floods. This report identifies flood damage reduction measures such as floodproofing and channel maintenance and land treatment measures such as terraces and conservation tillage that will reduce flood damages.

Flood-prone areas are a severe problem in Illinois. Watershed urbanization and development within the floodplain areas are increasing this problem. Currently there are 818 Illinois communities identified as having flood problems. As of June 30, 1983, 726 communities within Illinois are participating in the National Flood Insurance Program. The Illinois Department of Transportation Division of Water Resources (DWR) is the responsible state agency for urban flood control and for setting priorities for flood studies within urban areas. A joint coordination agreement was executed between the Division of Water Resources and the Soil Conservation Service (SCS) (April 30, 1976) and was revised (December 1978) to furnish technical assistance in carrying out these flood hazard studies. These studies are carried out in accordance with Federal Level Recommendation 3 of "A Unified National Program

for Floodplain Management," and Section 6 of Public Law 83-566. A plan of work was executed by DWR and SCS in November 1981 for the Village of Crossville, Flood Plain Management Study. The costs for this study were shared by the two agencies.

In April 1966, the Soil Conservation Service prepared a preliminary investigation report of the Elliott Creek Watershed in White County, Illinois. The Division of Water Resources prepared a reconnaissance study for flood control in the Village of Crossville in 1979, using much of the information from the SCS report. The average annual damages along Elliott Creek and its tributaries were estimated to be approximately $9,000 per year, based on 1966 dollars. The State of Illinois was asked by local citizens to provide assistance in solving the Crossville flooding problems. Prior to the state committing funds for flood control, it requires a floodplain management study to be completed which quantifies existing hazards in the area and alternative solutions. DWR requested that the floodplain management study display the beneficial and adverse impacts of the alternatives considered.

Detailed analysis was made of the hydrology, hydraulics, and damage to buildings along Elliott Creek, North Tributary, and Center Tributary in Crossville. The maps and profiles included in this report are adequate for floodplain regulations. The floodway delineated in this report was determined in accordance with Chapter 19, Illinois Revised Statutes of 1973, 65f. (Reference 4)

This floodplain management study, which includes a land treatment analysis, is sponsored by the Division of Water Resources, the White County Soil and Water Conservation District, and the Village of Crossville.

DESCRIPTION OF THE STUDY AREA

The Village of Crossville is located in the northeast corner of White County in southeastern Illinois close to the Indiana border. Crossville is 8 miles northeast of the county seat, Carmi, and approximately 30 miles northwest of Evansville, Indiana. It is approximately 50 miles east of Mt. Vernon, Illinois. The streams studied include Elliott Creek, which runs through the south and along the west side of the Village; Center Tributary, which flows through the central part of the community and enters Elliott Creek in the northwest part of the Village; and North Tributary, which flows west across the northern part of the community and enters Elliott Creek in the northwest part of Crossville. About 7 miles of stream were studied which included 5.2 miles of detailed study and 1.8 miles of limited study on the lower end of Elliott Creek. The 5.2 miles of detailed study includes: 3.6 miles on Elliott Creek, 0.4 miles on Northeast Tributary, 0.7 miles of North Tributary and 0.5 miles of Center Tributary. A gage record frequency analysis was done on the Little Wabash River to establish the backwater effect on Elliott Creek. (Reference 1 and 13)

The total drainage area of Elliott Creek and its tributaries is 13.3 square miles at the point where it joins the Little Wabash River 2 1/2 miles northwest of Crossville. The hydrologic sub-basin number is 05120114-090. Center Tributary has a drainage area of 0.80 square mile at its mouth, while North Tributary drains 1.25 square miles.

Existing land use in the watershed is primarily row crop (81%) with a significant portion (12%) in woodland. The remainder is urban, pasture, and roads. Most of the woodlands are located in the lower reaches of Elliott Creek and in scattered patches up and down the streams.

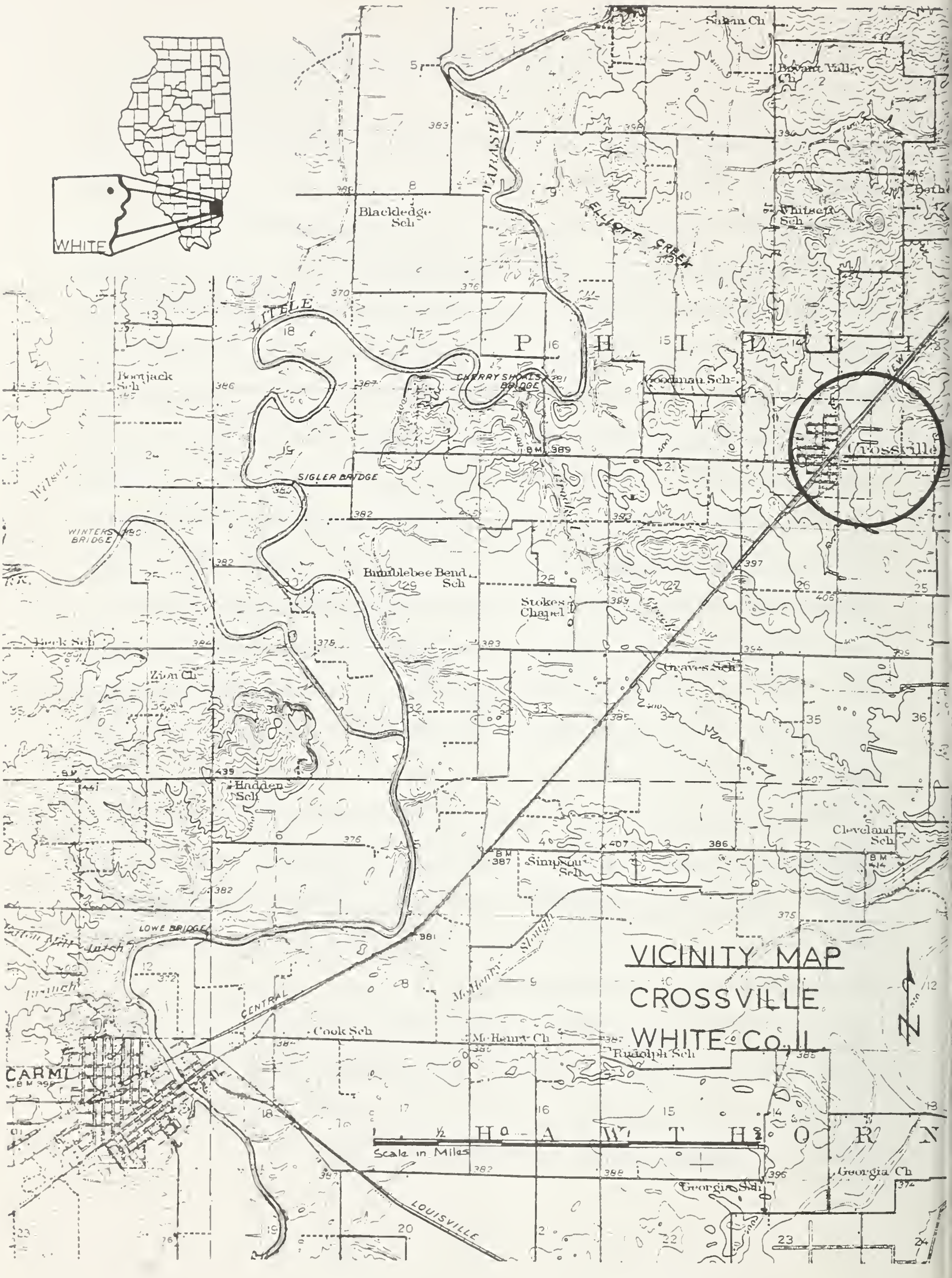

VICINITY MAP
CROSSVILLE
WHITE Co. IL.
Scale in Miles
WHITE
Crossville
CARMI
Blackledge Sch
Bootjack Sch
Bumblebee Bend Sch
Stokes Chapel
Goodman Sch
Graves Sch
Zion Ch
Hadden Sch
Simpson Sch
Cleveland Sch
Cook Sch
McHenry Ch
Rudolph Sch
Georgia Sch
Georgia Ch
Whitsett Sch
Bryant Valley Ch
Salem Ch
WABASH
ELLIOTT CREEK
LITTLE
CHERRY SHOALS BRIDGE
SIGLER BRIDGE
WINTERS BRIDGE
LOWE BRIDGE
CENTRAL
LOUISVILLE
McHenry Slough

FIGURE 1

The rolling upland areas are used primarily for row crop production. The estimated average annual soil loss exceeds ten (10) tons per acre in the watershed.

Crossville is a residential community with service and oil drilling oriented businesses. The 1970 census reported a population of 860. This increased 9.8% to 944 as recorded in the 1980 census. (Reference 9) For the same time period, White County increased 3.2% from 17,312 to 17,864, and the State of Illinois increased 2.8% from 11,110,285 to 11,418,461. Agricultural production in the watershed is primarily devoted to cash crops, such as corn, soybeans and wheat. Major transportation is provided by Illinois Highways 1 and 14, and the Penn Central Railroad.

The climate is classified as humid continental, characterized by warm summers and cold winters, with monthly and yearly variations in both temperature and precipitation. The average monthly precipitation by months is:

January	3.2	July	3.4
February	3.1	August	3.3
March	4.4	September	2.9
April	4.1	October	2.5
May	4.3	November	3.2
June	3.7	December	3.3

The average annual precipitation is 41.4 inches. (Reference 10) January temperatures range from a normal maximum of 42^{O}F to a normal minimum of 23^{O}F. July temperatures range from a normal maximum of 92^{O}F to a normal minimum of 66^{O}F. The average annual snowfall is 10 to 14 inches. The growing season in White County is 190 to 200 days per year. (Reference 3)

White County is underlain by Pennsylvanian bedrock, which is largely shale and not water-yielding. There are random spots of water-yielding sandstone and limestone. The surface of the bedrock lies buried beneath glacial deposits averaging 50 to 100 feet in thickness. (Reference 15) The glacial deposits consist of compact, silty glacial till underlying the hilly uplands. The till locally contains lenses of water-bearing sand and gravel. Lacustrine deposits, consisting of less dense clayey silt, underlie the relatively flat-lying lowlands between the uplands and floodplain elevations. The floodplain itself is underlain by modern silty alluvium. The upland areas are mantled by a discontinuous blanket of loess, which may vary up to several feet thick in places.

The land along Elliott Creek has a seasonal high water table and is subject to flooding. The lower reach acts as a backwater area for floodwater from the Little Wabash River. The bottomland hardwoods adjacent to Elliott Creek have been partially cleared for farming operations. During the last 20 years the cropping patterns in White County have shifted to more intense crop production. There has been a 46% increase in cropland, 45% decrease in woodland and a 70% decrease in pastureland during this period. Cropland in upland areas has increased erosion rates and resulted in sedimentation throughout the water courses of the Elliott Creek watershed. The primary watershed soils are Belknap, Hosmer, Marissa, Reesville, Sexton, Stoy, and Wakeland. Following are general descriptions of these soils.

Belknap soils are deep, nearly level to very gently sloping, light-colored soils that are somewhat poorly drained. These soils formed in thick, strongly acid silty sediment. The original vegetation was a forest of oak,

maple, gum, and hickory. These soils have a very high available moisture holding capacity. Permeability is moderately slow. The soils are low in available phosphorus and potassium.

Soils in the Hosmer series are very gently sloping to strongly sloping, light-colored soils that are moderately well drained. These soils have a moderately developed fragipan. They are on ridgetops and slopes in gently rolling parts of White County. Hosmer soils formed in wind deposited silty material (loess). The loess is more than 50 inches thick over loam or clay loam, Illinoian till or material weathered from sandstone. In most places the surface layer ranges from 8 to 14 inches in thickness. It is brown and granular in the upper part and brown to strong brown and platy in the lower part. Depth to fragipan is about 30 inches. These soils have moderate available moisture holding capacity. The layers above the fragipan are moderately permeable to moderately slowly permeable, and the fragipan is slowly permeable. Hosmer soils are strongly acid to very strongly acid and low in available phosphorus.

Soils in the Marissa series are deep, nearly level, moderately dark colored soils that are somewhat poorly drained to poorly drained. These soils formed under swamp grasses and trees in silty glacial sediment of Wisconsin age. The surface layer is very dark gray to dark-gray silt loam about 12 inches thick. These soils have high available moisture capacity and are moderately slowly permeable. These soils are medium in available phosphorus and potassium.

Reesville soils are deep, nearly level to gently sloping, light-colored and somewhat poorly drained. They formed in silty material 40 to 60 inches thick over medium textured sediment of the Wisconsin glacial age. The surface layer is generally grayish-brown silt loam about 6 inches thick.

These soils have high available moisture holding capacity and are moderately slowly permeable to moderately permeable. They are generally slightly acid to neutral. Reesville soils are low in available phosphorus and medium in potassium.

Sexton soils are nearly level, light-colored, and poorly drained. They formed in silty sediment under a forest of black oak and hickory. The surface layer generally is dark grayish-brown silt loam about 9 inches thick. These soils have high available moisture holding capacity and are slowly permeable. They are very strongly acid to slightly acid, and are low in available phosphorus. The subsoil at a depth of about 24 inches somewhat restricts growth of plant roots.

Soils of the Stoy series are deep, nearly level to gently sloping, light-colored loess. They were formed in silty windblown material, or loess, more than 50 inches thick over Illinoian glacial drift or over material weathered from sandstone. The surface layer generally is silt loam about 13 inches thick. These soils have high available moisture holding capacity, which can be increased somewhat under good management. They are slowly permeable. Stoy soils are strongly acid to very strongly acid, are very low in available phosphorus, and are low in available potassium.

Wakeland soils are deep, nearly level, light-colored and somewhat poorly drained. These soils formed in deep deposits of medium acid to mildly alkaline, silty sediment. The surface layer, a dark grayish-brown silt loam, is about 9 inches thick. Wakeland soils have high available moisture holding capacity and are moderately permeable.

NATURAL VALUES

Bottomland areas comprise about 12% of the watershed and are dominated by the Belknap-Bonnie-Wakeland soil association. All of these soils have a seasonal high water table at or near the surface, or in the case of Bonnie, water may be ponded. In addition, to the seasonal high water table, this soil association is commonly subject to flooding usually for brief durations in the spring. Native vegetation on this soil association consists of bottomland hardwood forests. Typical trees include Ash, Sycamore, Cottonwood, Elm, Silver Maple, Box Elder, Hackberry, and River Birch. Where these soils are drained and do not flood more often than once every two years during the growing season, they are classified as prime farmland.

The detailed study reach of Elliott Creek is about 3.6 miles in length. It is a low gradient stream without differentiation of pools and riffles varying in width from about 6 feet to about 20 feet. The bottom material is silt, and the stream carries a heavy fine grained sediment load. Bank vegetation consists of mixed hardwoods for the entire length. Woody vines, such as grape and poison ivy, are abundant in the understory along the lower half of the floodplain. Herbaceous vegetation was generally lacking in March 1982 and appeared to have been scoured off by flood waters or recently covered with sediment. The 2,000 feet of Elliott Creek immediately below the sewage treatment plant was channelized sometime between 1965 and 1973 and seeded to grass, but the banks are beginning to grow up with young Cottonwood, Ash, and other trees, from about 1 to 10 inches diameter breast height (dbh). Just below the channelized portion is a segment, about one quarter of a mile in length, that was rerouted many years ago. Out of bank flow in this section tends to cut northwesterly across cropland, presumably where the natural

channel once was. A mixed stand of uneven aged bottomland hardwood trees occupies the remainder of the banks beginning in section 15 and continuing downstream. A few trees had fallen across or into the creek forming snags, but there were no big log jams in March 1982. These simple snags probably averaged less than 2 or 3 per mile and because of their size contribute little in the way of habitat and flow restrictions.

The Crossville sewage plant is located near the junction of North Tributary and Elliott Creek and discharges directly into Elliott Creek. Although some evidence of oil and small amounts of trash were observed just below the plant there is no reason to suspect high levels of pollution in the creek from the treatment plant.

The watershed is intensively farmed and is mostly in cropland. There have been some significant shifts toward more intensive crop production during the last two decades. Additionally, the bottomland hardwoods adjacent to Elliott Creek have been partially cleared in order to bring more land into crop production, resulting in more runoff, less stable creek banks, and a higher chance of bank erosion and channel meanderings. Agricultural encroachment mistakenly assumes the creek channel will continue to follow its present course in the floodplain. Woodland vegetation helps to reduce the rate of meandering, holds the soil in place, and provides wildlife habitat. When the bottomland forests are converted to cropland those values are forfeited and sudden relocations of the channel course during floods may occur.

Wildlife habitat quality is generally poor. Intensive rowcropping has degraded wildlife habitat in the upland portions and encroachment of the riparian woods has reduced habitat quality and quantity in the bottomland areas.

Aquatic habitat quality is poor because the creek has a uniform silt bottom lacking pools, riffles, and differentiated substrates. Heavy sediment loading and the low gradient in the creek ensures low diversity of substrates and instream habitat structure.

There are no endangered or threatened species or suitable habitat for them in the project area. The Endangered Species "Redbook" (U.S. Fish & Wildlife Service) lists the range of the endangered Indiana bat as including all of southeastern Illinois and White County, but the Endangered and Threatened Species of Illinois (Sheviak and Thom, 1981) does not recognize the species as occurring in White County. White County is certainly within the historic range of the species, but there are no recent records to substantiate the presence of the Indiana bat in the county. Wooded riparian corridors are known to be good bat habitat but encroachment of the wooded corridor by agriculture and the poor aquatic habitat (which limits insect diversity) makes Elliott Creek poor habitat for Indiana bats. Two state listed plants occur in White County, but neither of them occurs in the silty alluvial soils characteristic of Elliott Creek.

According to the Illinois Department of Conservation there are no known archaeological or historical sites in the detailed study area along Elliott Creek and tributaries.

FLOOD PROBLEMS

The primary flood problems in Crossville are associated with Elliott Creek along with Center and North Tributaries. The area of most visible damage occurs on Center Tributary around the underpass at the junction of Highway 1 and the Penn Central Railroad. Flooding also occurs along Elliott Creek in the southwest portion of Crossville. A total of 75 acres of developed land is flooded in Crossville. Flood damage to farmland along Elliott Creek is limited to approximately 470 acres. Overland sheet flow from the cropland located east of the community causes water problems in residential areas. During storm events, the saturated ground conditions can result in seepage and sewer surcharge problems in residential areas.

Backwater from the Little Wabash River can inundate Elliott Creek to within one mile of the Village of Crossville. A large tributary entering Elliott Creek approximately 1.5 miles northwest and downstream of town with approximately equivalent drainage area also creates backwater effects on the mainstem of Elliott Creek. The upper end of this large tributary is steep and results in rapid rises in discharge. See Figure 1, "Watershed Map" for backwater delineation.

The community has had limited development in the last few years and does not expect substantial growth in the near future.

Significant floods occurred in July 1981 and December of 1982. Smaller floods occuring frequently cause farm roads to be impassable for several days.

The Soil Conservation Service has made a detailed damage survey of all existing development in the identified floodplain area. See Appendix A for

Location of these Buildings and Appendix E for Surveyed Elevations. A total of 55 buildings have been identified that are subject to flooding along Elliott Creek and its tributaries by the .2% chance or 500 year flood. The following table summarizes the damage analysis:

Crossville, Illinois

Flood Frequency (Years)	Buildings Flooded No.	Dollars Damage (1983)
500	55	359,300
100	42	202,900
50	35	158,400
25	24	98,800
10	19	56,100
5	15	31,400
2	9	10,000

Average Annual Damages = $21,105

It is estimated that an additional 90 properties are subject to yard damage but do not have damage to the building. Estimated average annual yard damage is $1,660.

Traffic along Highway 1 is interrupted during major storms at the weigh station and the railroad underpass. Average annual damage due to the interruptions is estimated to be $350.

The floodplain maps included as Figure 4 and 5 of this report identify

both the 100 year and the 500 year floodplains along the study reaches in Crossville. The profile sheets are included as Appendix B. Appendix B specifically identifies the water surface elevations for different frequency floods for locations along the study reaches. The profile sheet can be used to identify the specific elevations for any given frequency flood.

The potential for flood damages increasing in the future depends primarily upon the regulation of new development and channel maintenance. With the community regulating all future developments such that new building elevations are above the 100 year or 1% chance event, new development will not be subject to serious flood damage. If the channels through Crossville are maintained free of brush and snags, the flood hazard should not increase further. It will actually decrease compared to conditions in 1981.

Local citizens will be able to use the data included in this report to protect their homes with flood proofing measures. Additional data on flood proofing can be obtained from the Illinois Division of Water Resources.

EROSION AND SEDIMENT PROBLEMS

Relatively severe erosion problems occur in the cropland portions of the watershed. Soil losses caused by sheet and rill erosion often exceed 10 tons per acre per year, locally being in excess of 20 tons per acre per year. At the present time, total sheet and rill erosion in the watershed is estimated to be about 58,200 tons annually. As overland sheet flow runs down the hillsides, it quickly collects into small channels. Scour in these channels, or megarills, causes an additional 14,400 tons of erosion each year.

In contrast, erosion in the major channels, such as Elliott Creek and its principal tributaries, is a less significant problem. Most of the erosion in the main channels probably occurs early in a given storm, when rising velocities scour streambed sediment deposited during the waning phases of the previous flood event. Most of this sediment was derived from sheet, rill, and megarill erosion of the cropland. Locally, streams may erode in-place soils from their banks and degrade their beds, but such erosion is generally confined to artificially straightened sections or reaches where the banks have been stripped of vegetation.

The degree of stability and sediment transport capability of major channels was estimated by geomorphic methods (see References 16 and 17). The analysis in Appendix F indicates the Elliott Creek channel is comparatively stable, but is relatively inefficient in transporting sediment. The large alluvial floodplain in the downstream portions of the watershed, the relatively low channel capacity, and the relatively high top width/depth ratios for a channel in fine-grained sediment all support these interpretations. The average accretion rate of the floodplain area may be as high as about 0.03 feet per year. The actual amount of sediment deposited at a particular place

during a given flood will, of course, vary considerably from the average. In fact, at least a few acres of the floodplain are subject to scour. The sediment deposits are believed to be mostly silt with clay, perhaps with a little fine sand.

The average discharge of sediment from Elliott Creek to the Little Wabash River is estimated to be about 8,300 tons per year. Therefore, most of the annually eroded sediment, or about 46,900 tons, remains trapped on the floodplain or in channel-bottom deposits. An additional 17,400 tons, or about 24% of the total annual erosion, remains trapped on the cropland fields, due to inefficiencies in the processes which transport sediment eroded by overland flow.

EXISTING FLOODPLAIN MANAGEMENT

Currently the Village of Crossville is in the process of converting from the emergency phase of the National Flood Insurance Program to the Regular Program. A draft Flood Insurance Study has been prepared. This program provides data to the community such that the local government can adopt floodplain management measures. Each flood insurance study includes a flood boundary map with a floodway designed to assist the community in establishing the rules used to regulate land use. The data included in this floodplain management study is comparable to a flood insurance study and was used by the National Flood Insurance Program to delineate the 100 year floodplain and floodway in Crossville.

The local community is implementing floodplain regulations as required by the Flood Insurance Program. A local steering committee was formed at the start of this study and provided input at meetings held March 15, 1982, May 17, 1982 and April 25, 1983. In addition local residents were contacted and interviewed during field trips by the engineer and economist.

In order to provide a national standard without discrimination, the 100 year flood (1% chance) has been adopted by State and Federal agencies as the base flood for purposes of floodplain management measures. The 500 year (0.2% chance) flood is employed to indicate areas of additional flood risk within a community. For all the streams studied in detail, the boundaries of the 100 year and 500 year flood have been delineated. These flood boundaries have been determined by using the flood elevations calculated for each valley cross section. Between the surveyed cross sections the floodplain boundaries were interpolated using topographic maps prepared at a scale 1"=200' (contour

interval of 2'). In cases where the 100 year and 500 year flood boundaries are close together only the 100 year boundary has been shown. The boundaries of the floodplains are shown in Figures 4 and 5. See Table 1 for a summary of the discharges used to define the floodplains.

Small areas within the flood boundaries may lie above the flood elevations and therefore not be subject to flooding. However, due to the limiting scale of the topographic maps used to prepare the floodplain maps, such areas are not delineated. The profile sheets in Appendix B should be used to ascertain flood elevations for any specific point.

Encroachment on floodplains, such as artificial barriers, reduce the water carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from the floodplain development against the resulting increased flood hazard.

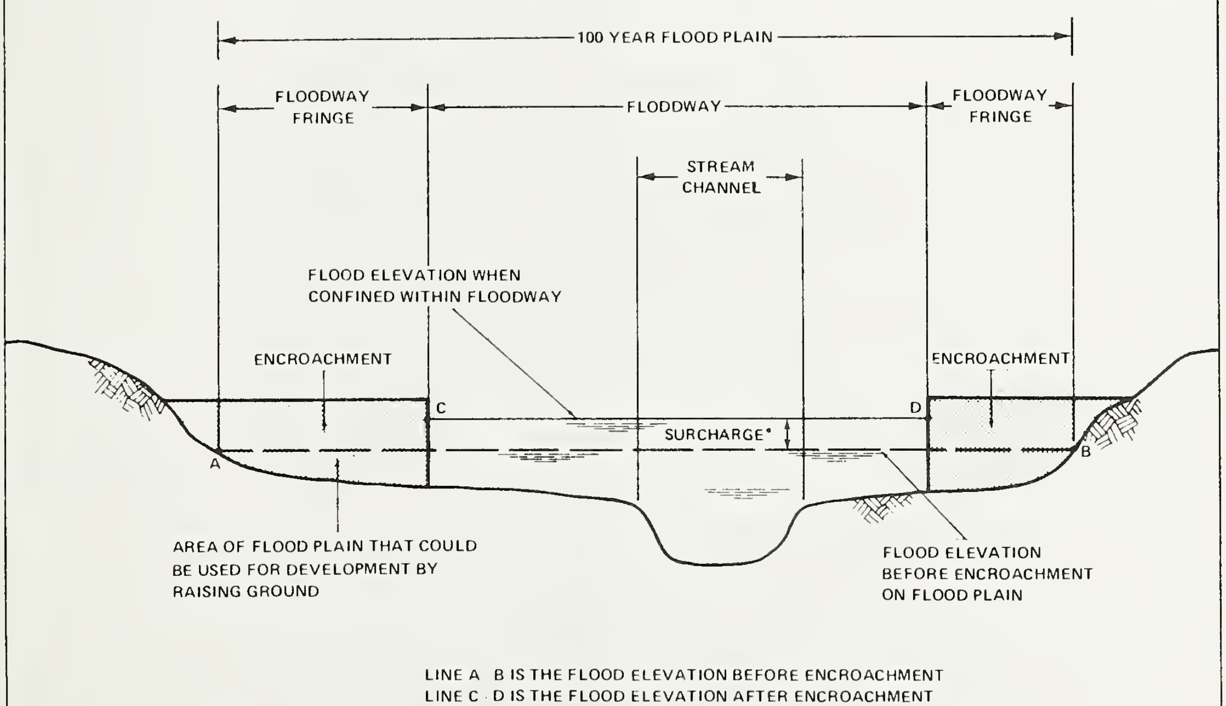
For purposes of the flood insurance program the concept of a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100 year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of the stream plus any adjacent floodplain areas that must be kept free of encroachment in order that the 100-year flood can be carried without a substantial increase in flood heights.

In Illinois the minimum standard used to define the 100 year floodway is described in the Illinois Revised Statutes of 1973 under 65f, Chapter 19. In this standard the encroachment in the floodplain is limited to that which will cause only an insignificant increase in flood heights. The Illinois Division of Water Resources has recommended that the floodway be determined using no more than a 0.1 foot surcharge. (Reference 2) The 0.1 foot surcharge floodway

proposed for this study was computed by equal conveyance reduction from each side of the floodplain.

As shown on the flood boundary and floodway maps in Figures 4 and 5, the floodway boundaries were determined at individual cross sections. Between the cross sections the boundaries are interpolated.

The area between the floodway and boundary of 100 year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevations of the 100 year flood more than .1 of a foot at any point. The typical relationship between the floodway fringe and the floodway are shown in the floodway schematic (Figure 2).



*Surcharge not to exceed 0.1 foot, as in the Illinois Division of Water Resources Guidelines.

FIGURE 2

FLOODWAY SCHEMATIC

ALTERNATIVES FOR FLOODPLAIN MANAGEMENT

Several floodplain management strategies including present condition, land treatment, nonstructural measures, structural measures, and a combination of measures were evaluated. A brief description of these alternatives follows:

Present Conditions (No action)

The community would regulate new construction using available mapping. The existing businesses subject to major damage could relocate or continue accepting flood damage on a regular basis. Limited flood insurance coverage would remain available but residences and businesses with significant flood damage could not obtain adequate insurance protection. Existing problems would continue or get worse.

Land Treatment

An erosion inventory and land treatment needs evaluation was made for the entire watershed. A summary of this evaluation and three treatment alte - natives for watershed protection are contained in Appendix F. A review of these alternatives shows that none of them would have a significant impact on peak discharges. All of them reduce the rate of sediment deposition on the floodplain.

Nonstructural Measures

1. Flood Insurance: The community is currently cooperating with the National Flood Insurance Program and a limited amount of flood insurance is currently available for all residents of Crossville. Through use of the maps and profiles prepared as part of this FloodPlain Management Study the community is converting to the Regular Flood Insurance Program. This will allow all who want, to increase their flood insurance to the value of their property.

In addition, the businesses will be able to cover their losses by purchasing adequate insurance at an actuarial rate.

In order for the community to convert to the regular flooding program, they are updating their existing floodplain regulations to require building permits prior to construction of any new development in the 100-year floodplain.

2. Floodproofing: Floodproofing measures are as many and varied as the types of buildings they are designed to protect. They may range from elevating damageable building contents above expected flood elevations to raising or moving the entire structure. They can be both permanent such as structural modifications or temporary such as having sandbags available to block a low entry point when a flood occurs.

Forty-two buildings are flooded by the 100-year (1% chance) flood. Of these, six are house trailers and could easily be flood proofed by raising them above the 100-year elevation or by relocation. Ten others are sheds or garages that could have damage to contents eliminated or drastically reduced by elevating the contents above the 100-year flood elevation. The ten business properties that are flooded could keep content damage to a minimum by elevating water damageable contents above the 100-year flood elevation or completely eliminate damages by permanently modifying (raising) low water entry points or having sandbags on hand to temporarily seal these points. Thirteen of the buildings are houses on crawl spaces or slabs. Of these, seven could have damages due to the 100-year storm practically eliminated using temporary measures such as sandbagging low water entry points. The remaining six would require some sort of structural modification or addition to or around the low water entry to eliminate damages. There is one bi-level house in Crossville that is subject to damage by the 100-year flood. An

effective floodproofing measure might be some well placed landscaping fill and grading to keep water away from the house. This would have to be done carefully to avoid creating a drainage problem around the house. Two houses with basements are flooded by the 100-year storm. Both could have damages substantially reduced or practically eliminated by a combination of structural modifications and temporary floodproofing measures.

3. Channel Maintenance: The Village of Crossville has taken upon itself the responsibility of removing the brush and debris from the channel bottom and banks along Elliott Creek from west Main Street downstream to the first bridge northwest of the sewage treatment facility; maintenance is also being performed along Center Tributary from Route 1 to its confluence with Elliott Creek and on North Tributary below north State Street. An alternative was evaluated that consisted solely of this type of maintenance for the reach stated above. This proved to be the most cost effective alternative evaluated with an approximate benefit to cost ratio of 5.6:1. It was estimated that this alternative would have an initial cost of $15,000 with annual O&M costs of $1,000.

A brief evaluation was made of removing all log jams and vegetation growing inside the channel banks for the next 1.5 miles of channel downstream of where the city has stopped their maintenance program. The work would not reduce damages in the village and might result in causing additional erosion problems along Elliott Creek.

The maintenance of a naturally wooded riparian corridor for the length of Elliott Creek downstream of the first bridge northwest of the sewage treatment facility would minimize bank erosion, improve stability, and provide a buffer zone in which the channel could meander without eroding into adjacent crop fields. For a stream of this size, the suggested width of the riparian

corridor would be about a 100 feet wide at the upper end and about 500 or more feet wide or wider at the lower end where it approaches the Little Wabash River.

Structural Measures

Structural measures evaluated fell into three basic types. One consisted of channel modifications with the intent to reduce the elevation of the water surface profiles through the community. Another consisted of a combination of terraces and water and sediment control basins to provide temporary storage for storm runoff to lower the peak discharges for a given frequency storm. A third consisted of channel-type diversions to divert storm flows away from the floodprone areas to other areas where the volumes of runoff from large events would cause less damage.

B. Channel Modifications: Combinations of 10 and 16 foot bottom widths with 3 to 1 side slopes and varying lengths of channel were evaluated. The enlarging alternatives for Elliott Creek were extended from above (southeast) the community to the second bridge below (northwest) the sewage treatment plant. Although the enlarged channel showed significant reduction in the water surface profile along the lower section, elevations were not significantly lowered in Crossville. The analysis of this alternative was discontinued at this point due to the very large estimated construction cost versus the relatively small reduction in average annual damages to Crossville.

Analysis of channel enlarging alternatives along Center and North Tributaries was discontinued due again to the very large construction costs in relation to the offsetting benefits. Construction costs for enlarging these tributaries would include relocating or removing several buildings as well as enlarging

many road crossings and rebuilding side inlets and storm sewer outfalls. Costs for a 10 foot bottom width channel with 3:1 side slopes were developed for:

a) Elliott Creek from the sewage treatment facility upstream beyond south State Street,

b) Center Tributary from its confluence with Elliott Creek upstream beyond the Penn Central Railroad grade, and

c) North Tributary from its confluence with Elliott Creek upstream beyond north State Street.

These costs, not including money for land rights, relocation, or enlarging road crossings, were in excess of $200,000. The overall benefit to cost ratio is less than 0.5:1.0.

Terraces and Water and Sediment Control Basins: These measures could be constructed on suitable upland portions of the watersheds of Center and North Tributaries. Terraces would serve a two-fold benefit in this situation. They would help reduce sheet, rill and ephemeral gully erosion on sloping cropland as well as provide temporary storage for storm runoff. Suitable sites for the terraces and water and sediment control basins were selected by field investigation. With a total of 430 acres terraced in the drainage areas of North and Center Tributaries the average annual flood damage in Crossville could be reduced by 53%. This alternative had a flood damage reduction benefit to cost ratio of 0.8:1.0 using the estimating cost of $175,000 for construction, engineering and project administration. Additional benefits would be gained by land users in soil resource base protection.

Diversion Channels: Channels to divert Center Tributary floods to Elliott Creek south of town and North Tributary floods north of town were evaluated. The analysis of the proposed diversion for Center Tributary was

discontinued when it became obvious that adding more water to Elliott Creek southeast of town would significantly increase flood damage on Elliott Creek through town.

The North Tributary diversion was proposed to intercept water on North Tributary just below north State Street and intersect with Elliott Creek approximately one quarter of a mile below (northwest) the sewage treatment facility. With estimated costs ranging from $200,000 - $250,000 excluding landrights, this alternative had a benefit to cost ratio of less than 0.2:1.0.

Combination of Alternatives: An alternative was evaluated in an attempt to eliminate the flood damages in the largest damage reach (Center Tributary) by combining the channel maintenance alternative with 170-180 acres terraced in the watershed of Center Tributary. The effect of this alternative was to decrease the average annual damage from approximately $21,100 to approximately $7,800. Estimated average annual costs were $9,700 for a benefit to cost ratio of 1.4:1.0. Nineteen buildings would still incur damages from the 100-year flood event if this alternative were adopted and installed. Of these, fifteen could have damages substantially reduced through a combination of permanent and temporary floodproofing measures. It is estimated that these floodproofing measures could further reduce average annual damages in Crossville to approximately $5,850.

GLOSSARY AND REFERENCES

<u>Conservation Cropping System</u> - The growing of crops by using a combination of needed cultural and management measures. Cropping systems include rotations that contain grasses and legumes, as well as rotations in which the desired benefits are achieved without the use of such crops.

<u>Conservation Tillage System</u> - A form of noninversion tillage that retains protective amounts of residue mulch on the surface throughout the year. These include no-tillage, strip tillage, stubble mulching, and other types of noninversion tillage.

<u>Chisel Till</u> - Seedbed prepared by chisel plow, disk, or similar implement leaves crop residue on the soil surface after planting.

<u>No-Till</u> Soil is disturbed only in immediate area of the seed row and all crop residues are left on the surface after planting.

<u>Contour Farming</u> - Farming sloping lands in such a way that all tillage operations are done on the contour. (This includes following established grades of terraces or diversions.)

<u>Encroachment</u> - Obstruction in part of a floodplain which reduces floodwater carrying capacity, therefore increasing flood stages.

<u>Floodway</u> - The portion of a floodplain required to convey flood waters without causing significant increases in flood heights or velocities.

<u>Fringe Area</u> - Portions of the floodplain outside of the floodway subject to shallow inundation and low velocity flow.

Flood - An overflow of water on to land not normally covered by water. This inundation of land is temporary, and the land is normally adjacent to a river or stream, lake, or other body of water. Normally, a "flood" is considered as any temporary rise in stream flow or stage that causes a significant adverse effect. Adverse effects would be damage to property, sewer backup, creation of unsanitary conditions, sedimentation, accumulation of debris, or other problems.

Flood Crest - The maximum stage or elevation reached by the waters of a flood at a given location. It may be referred to as flood stage or high water elevation.

Flood Peak - The maximum instantaneous discharge at a given location. It usually occurs at or near the time of the flood crest.

Floodplain - The relatively flat area or low lands adjoining the stream channel, or water course, lake, or other body of water, which has or may experience flood water.

Grade Stabilization Structures - A structure to control the grade and head cutting in natural or artificial channels.

Grassed Waterway or Outlet - A natural or constructed waterway or outlet, shaped, or graded, and established in suitable vegetation for the safe disposal of runoff.

Head Loss - The effect of natural or man-made obstructions such as small bridge openings, buildings, fill, or accumulation of debris which limits the conveyance of water, causing a rise in upstream water surface elevation.

High Water - Profile — A graph showing the relationship of water surface elevation to location along the water course. The profile is normally drawn for a specific flood.

100-year - Flood — A flood having an average frequency of occurrence of once in 100 years. It has a 1% chance of being equalled or exceeded in any one year. It may occur in any year. It is based on a statistical analysis.

Terraces - An earth embankment, a channel or a combination ridge and channel constructed across the slope to reduce slope length and to intercept, temporarily store, and safely convey runoff water underground to a suitable outlet.

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TABLE 1
SUMMARY OF DISCHARGES - PRESENT CONDITION
CROSSVILLE, ILLINOIS

Stream	Location	Drainage Area Square Mile		Peak Discharge by Frequency		
			10 Year cfs	50 Year cfs	100 Year cfs	500 Year cfs
Elliott Creek	Highway 1/14 near weigh Station	1.4	600	870	940	1150
Elliott Creek	at sewer Treatment Plant	3.7	1570	2200	2370	2890
Elliott Creek	at county road near north central edge of Sec. 15 T.4S. R.10E.	11.7	4200	6450	7000	9000
Center Tributary	at Highway 1	0.5	520	750	810	1000
Center Tributary	at junction with Elliott Creek	0.8	570	810	890	1000
North Tributary	at North State Street	1.2	800	1140	1240	1530
North Tributary	at junction with Elliott Creek	1.3	590	840	900	1220
Northeastern Tributary	at junction with Elliott Creek	6.1	2680	3970	4340	5470

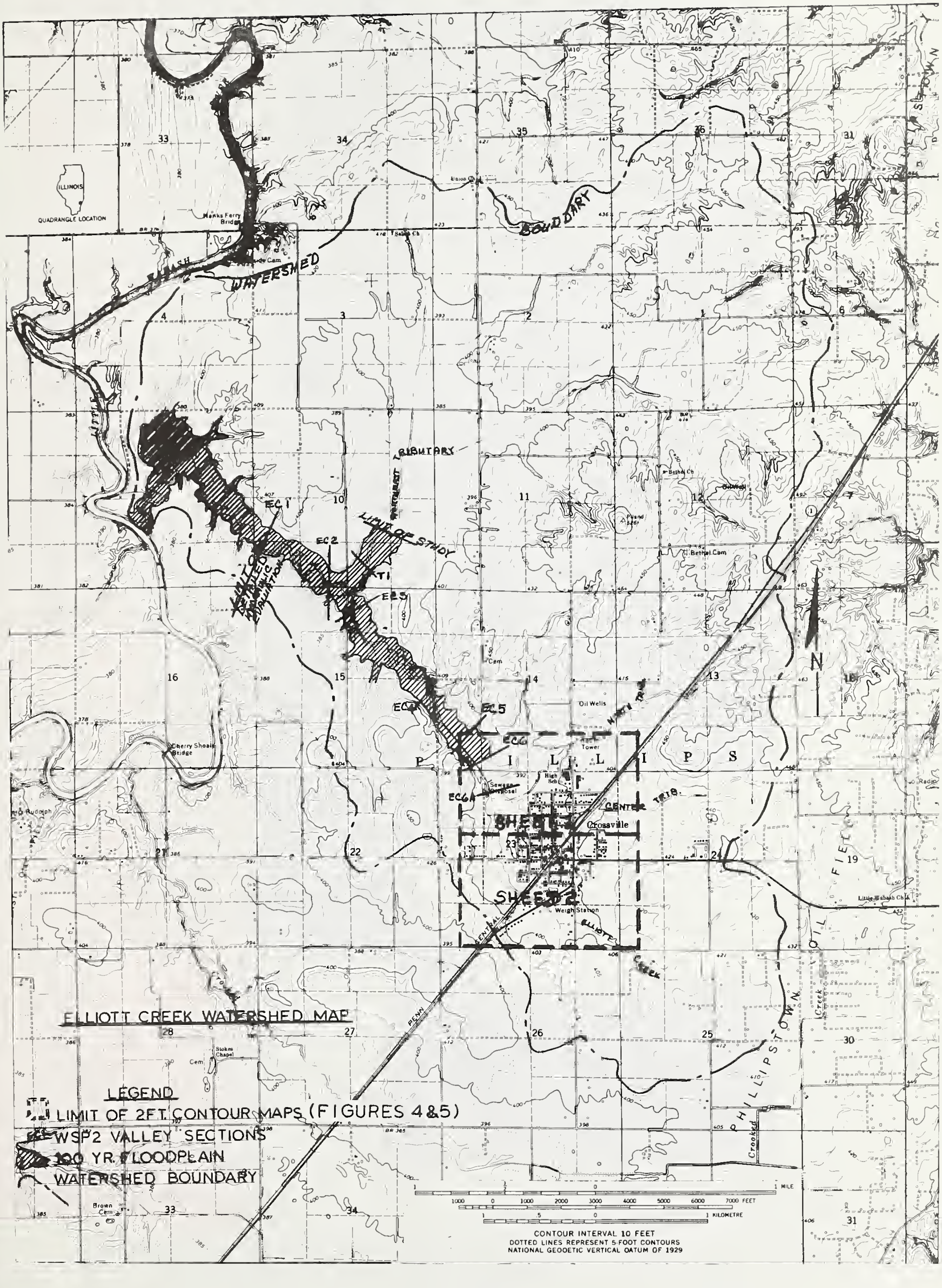
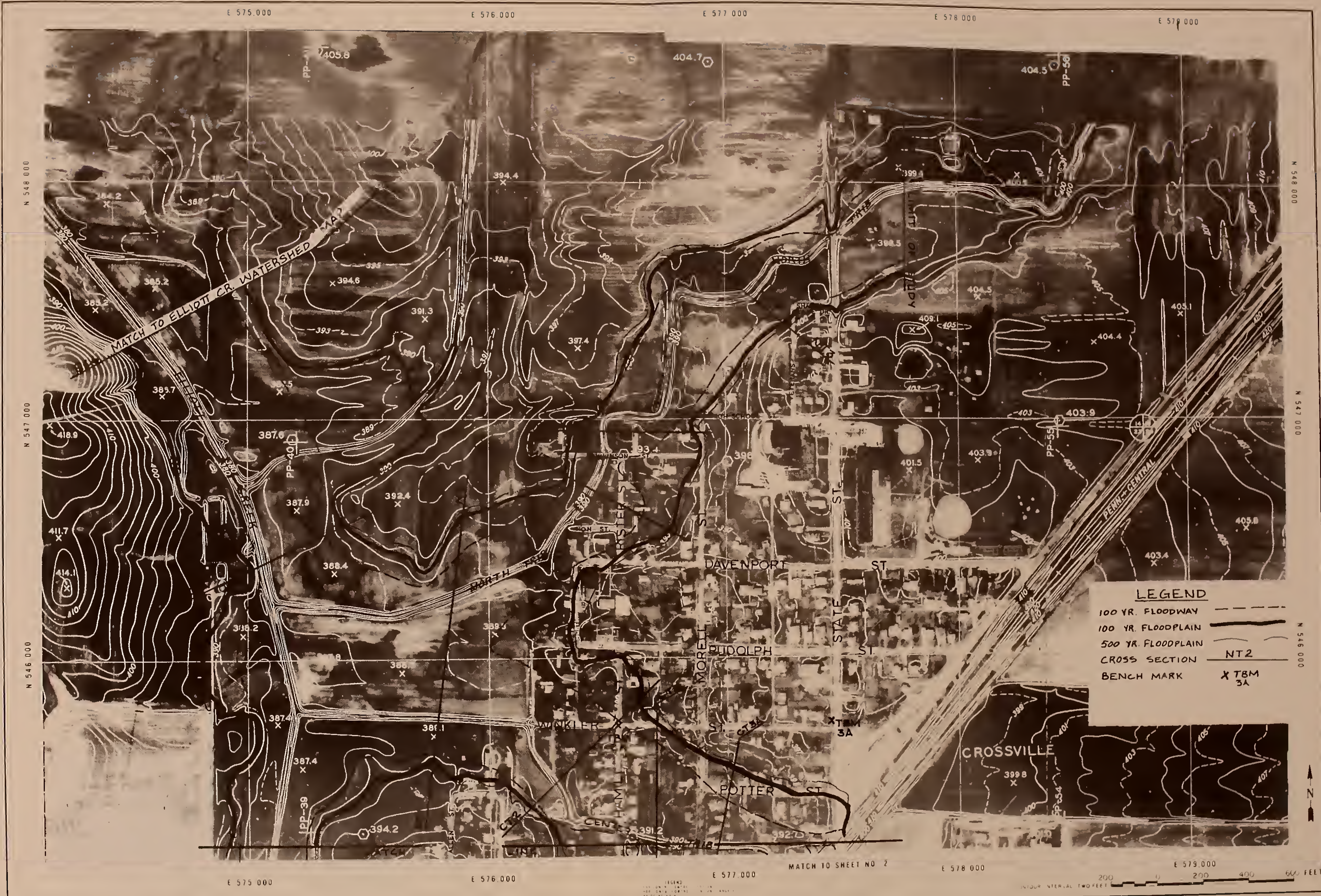
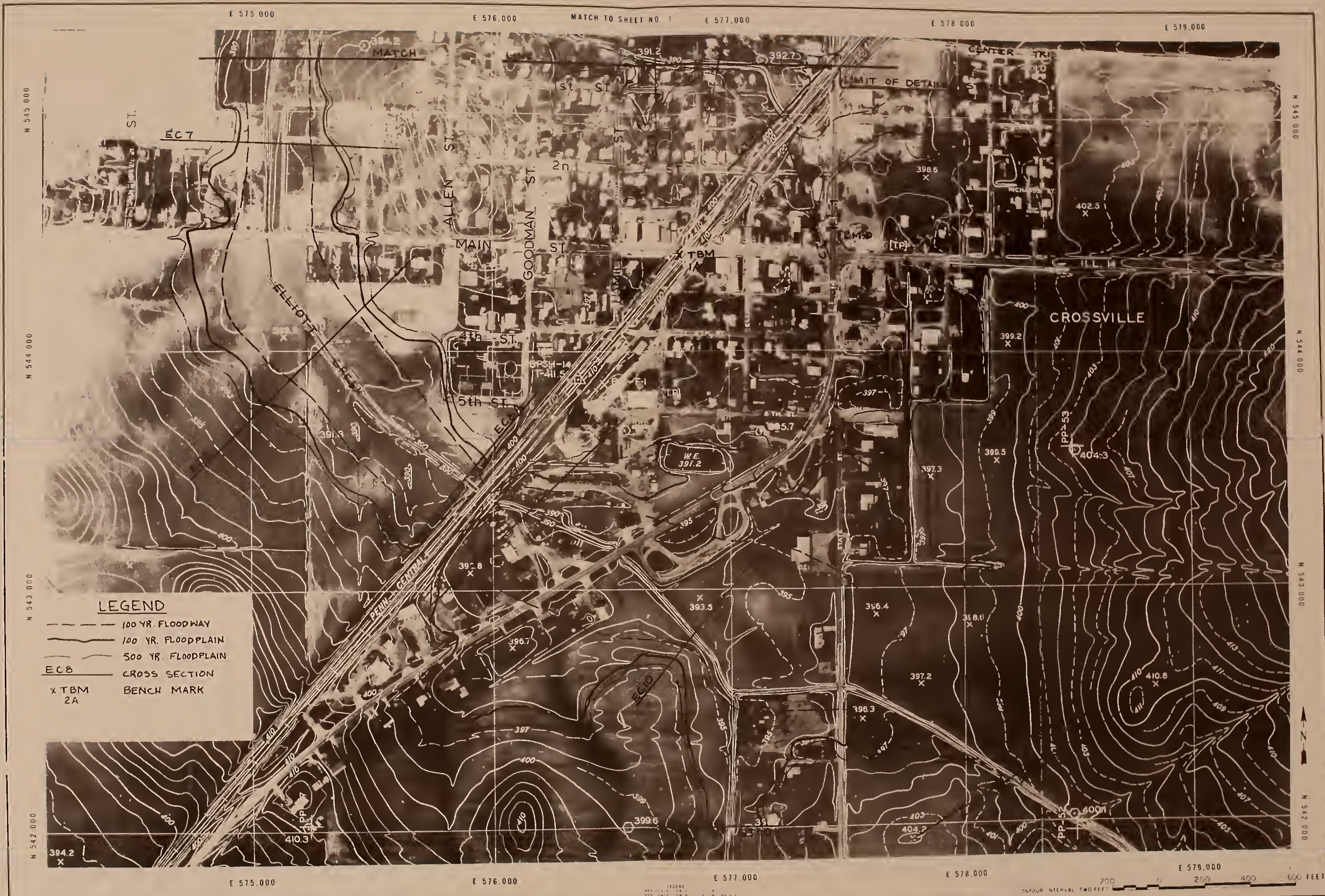

ELLIOTT CREEK WATERSHED MAP
LEGEND
LIMIT OF 2FT CONTOUR MAPS (FIGURES 4&5)
WSP2 VALLEY SECTIONS
100 YR. FLOODPLAIN
WATERSHED BOUNDARY
WATERSHED
BOUNDARY
TRIBUTARY
LIMIT OF STUDY
EC1
EC2
EC5
SHEET 1
SHEET 2
CENTER TRIB.
ELLIOTT CREEK
Crossville
PHILLIPSTOWN OIL FIELD
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FIGURE 3



PREPARED BY AERIAL SURVEYS DIVISION OF HIGHWAYS	DATE OF PHOTOGRAPHY 3-24-81 DATE OF MAPPING 6-81	PREPARED FOR ILLINOIS DEPARTMENT OF TRANSPORTATION DIVISION OF WATER RESOURCES	FLOODPLAIN TOPOGRAPHIC MAP CROSSVILLE FLOOD PLAIN STUDY WHITE COUNTY, ILLINOIS	PROJECT NO. WL-1138 SHEET 1

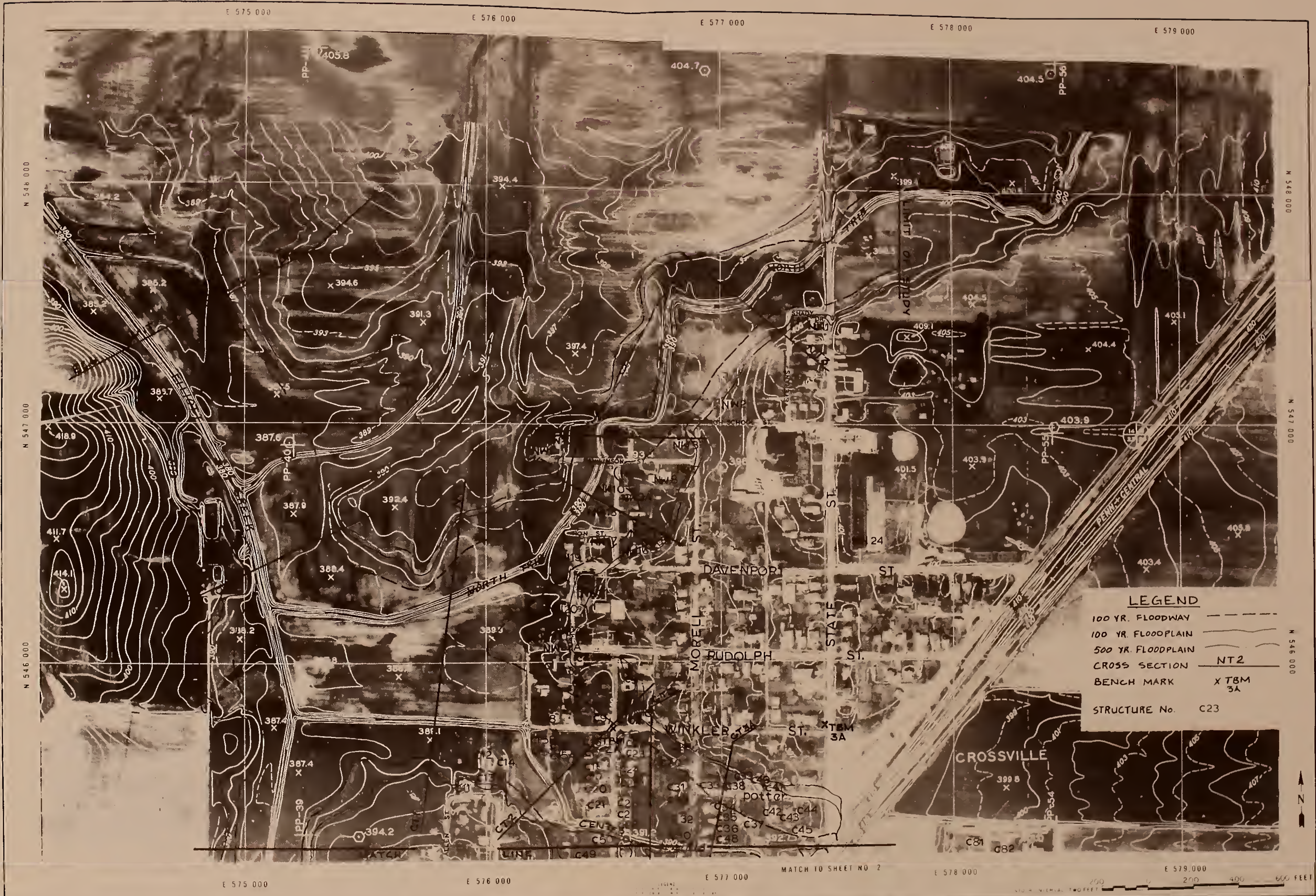
FIGURE 4



PREPARED BY	AERIAL SURVEYS DIVISION OF HIGHWAYS	DATE OF PHOTOGRAPHY 3-24-81 DATE OF MAPPING 6-81	PREPARED FOR	ILLINOIS DEPARTMENT OF TRANSPORTATION DIVISION OF WATER RESOURCES	FLOODPLAIN TOPOGRAPHIC MAP CROSSVILLE FLOOD PLAIN STUDY WHITE COUNTY, ILLINOIS	PROJECT NO. WL-1138 SHEET 2

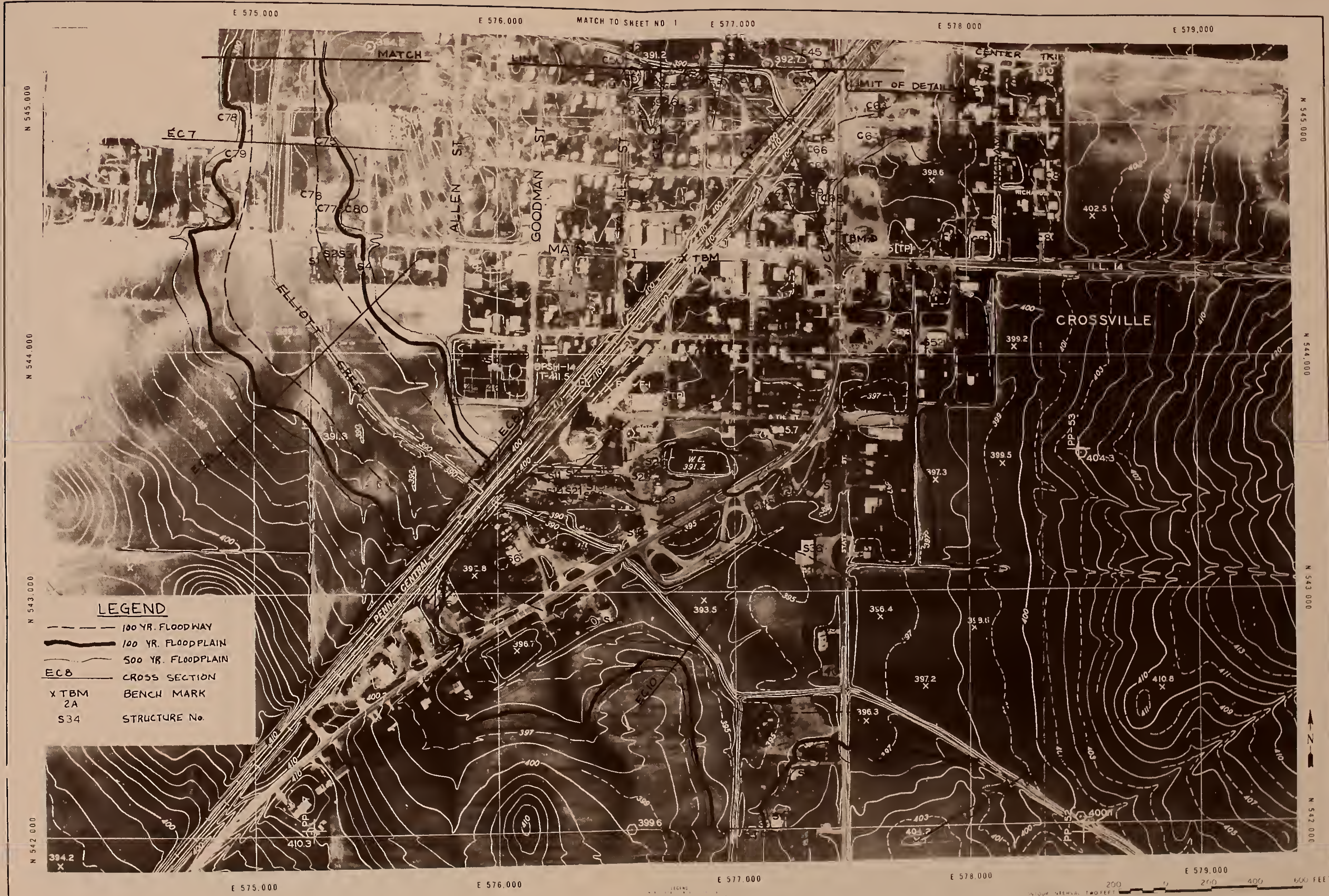
Figure 5

APPENDICES



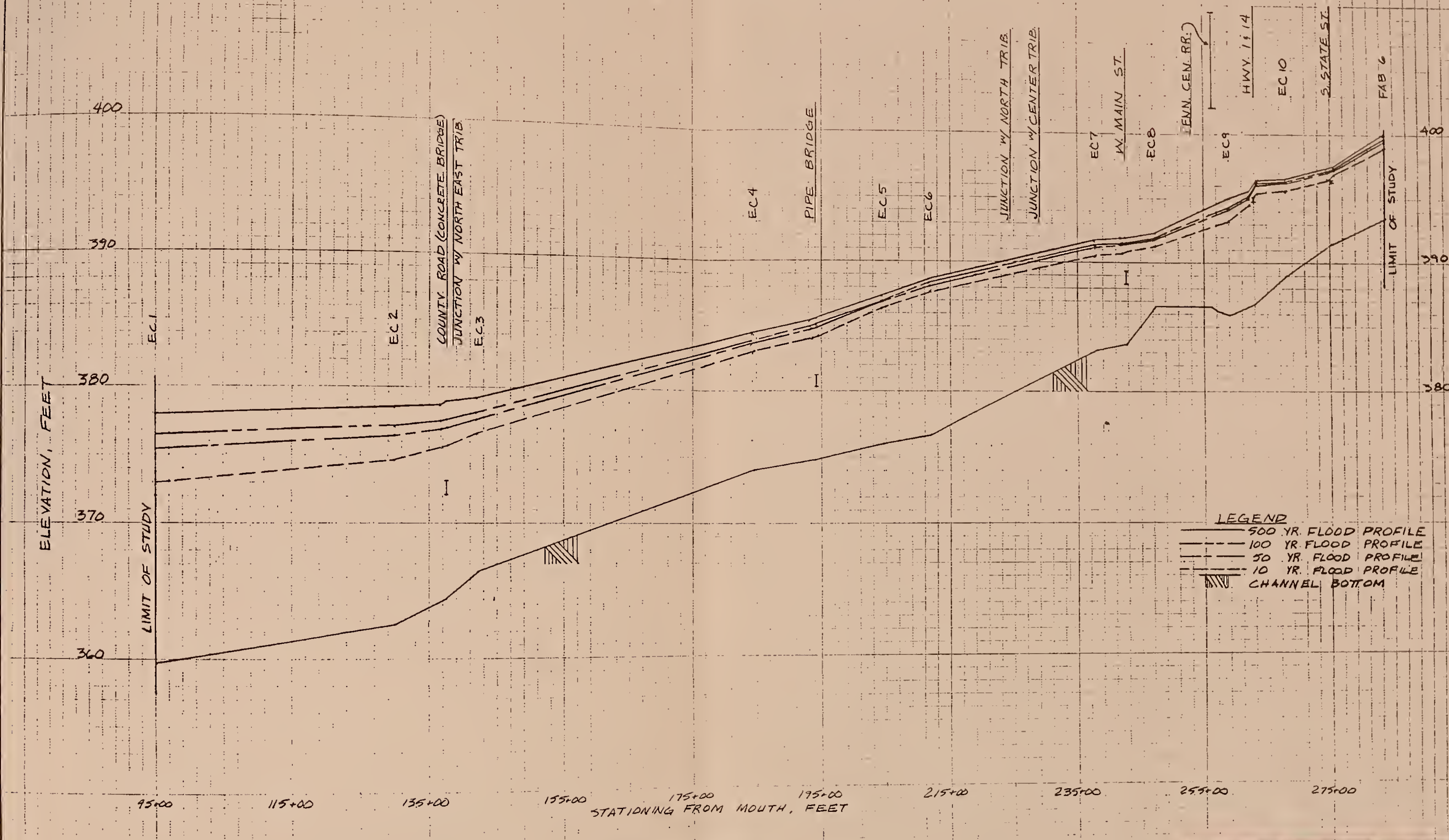
PREPARED BY	AERIAL SURVEYS DIVISION OF HIGHWAYS	DATE OF PHOTOGRAPHY 3 24 81 DATE OF MAPPING 6-81	PREPARED FOR	ILLINOIS DEPARTMENT OF TRANSPORTATION DIVISION OF WATER RESOURCES	BUILDING LOCATION MAP CROSSVILLE FLOOD PLAIN STUDY WHITE COUNTY, ILLINOIS	PROJECT NO. WL-1138 SHEET 1

APPENDIX A



PREPARED BY	AERIAL SURVEYS DIVISION OF HIGHWAYS	DATE OF PHOTOGRAPHY 3 24 81 DATE OF MAPPING 6-81	PREPARED FOR	ILLINOIS DEPARTMENT OF TRANSPORTATION DIVISION OF WATER RESOURCES	BUILDING LOCATION MAP CROSSVILLE FLOOD PLAIN STUDY WHITE COUNTY, ILLINOIS	PROJECT NO. WL-1138 SHEET 2

APPENDIX A



ELLIOTT CREEK

CROSSVILLE FLOODPLAIN MANAGMENT STUDY
WHITE COUNTY, ILLINOIS
ELLIOTT CREEK

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	
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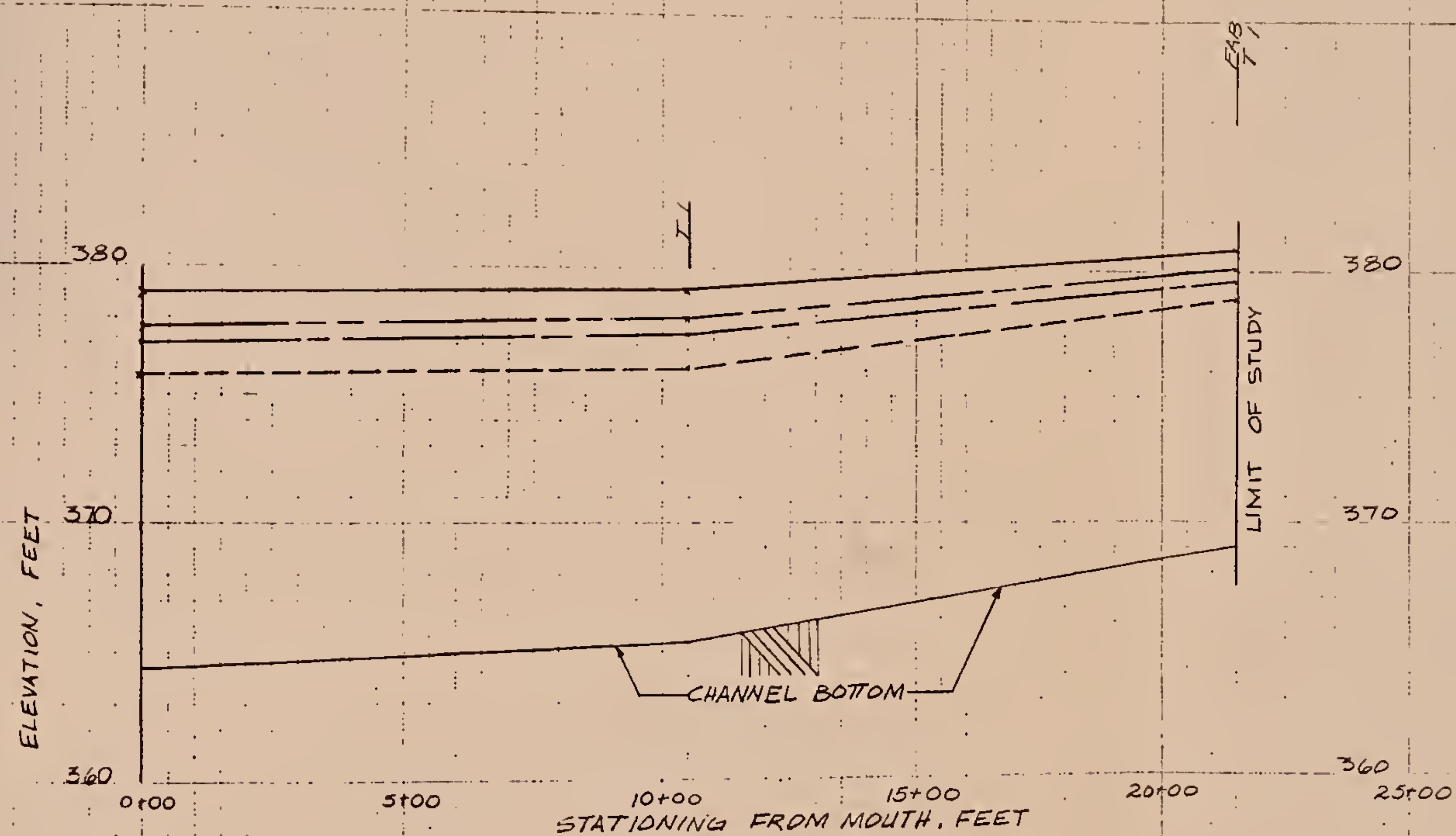
Traced	
Checked RMB	6/83

APPENDIX B

SHEET 1



NORTH EAST TRIB

LEGEND

———	500 YR FLOOD PROFILE
— — —	100 YR FLOOD PROFILE
— - —	50 YR FLOOD PROFILE
— — —	10 YR FLOOD PROFILE

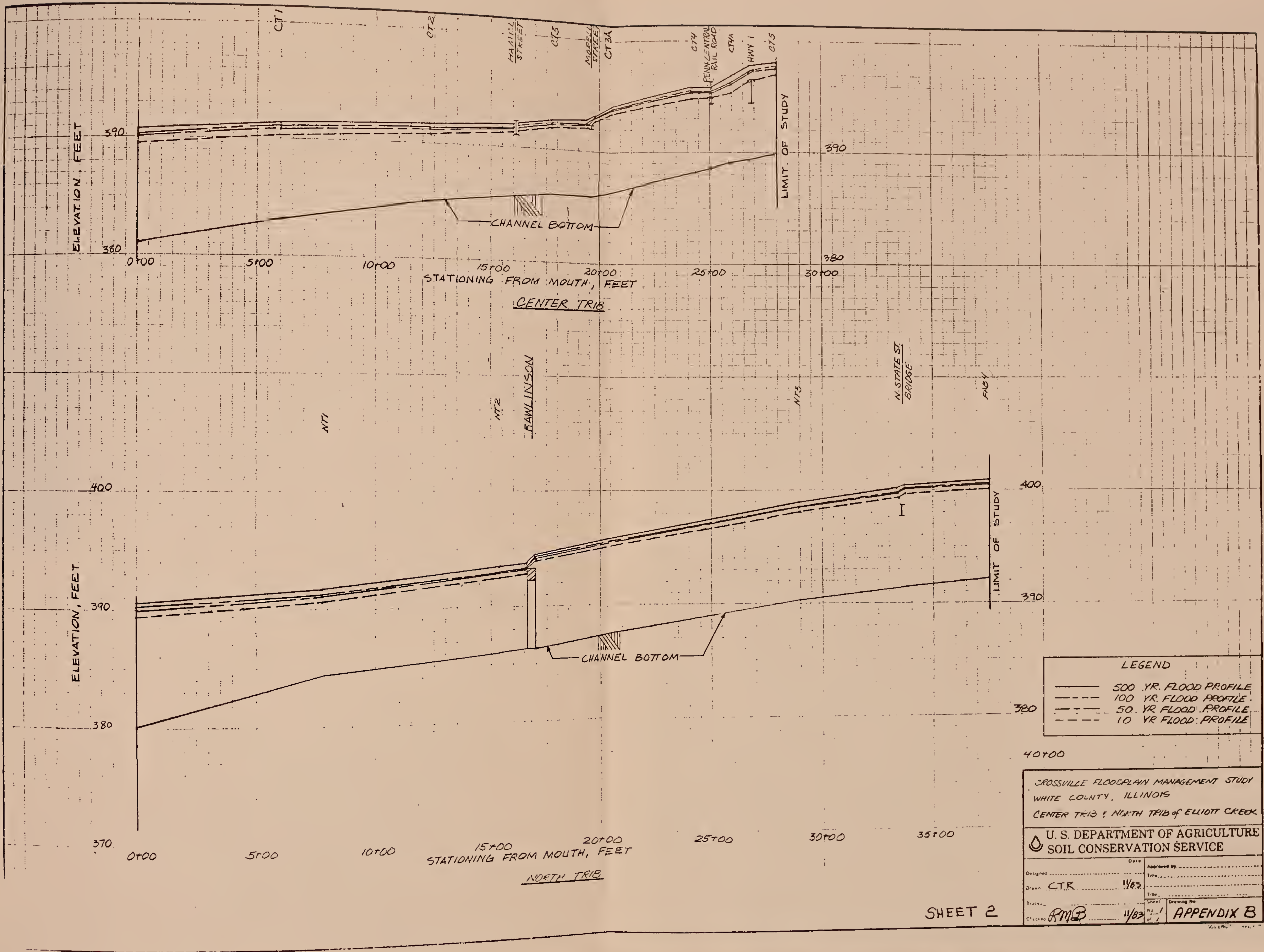
PRESENT CONDITION

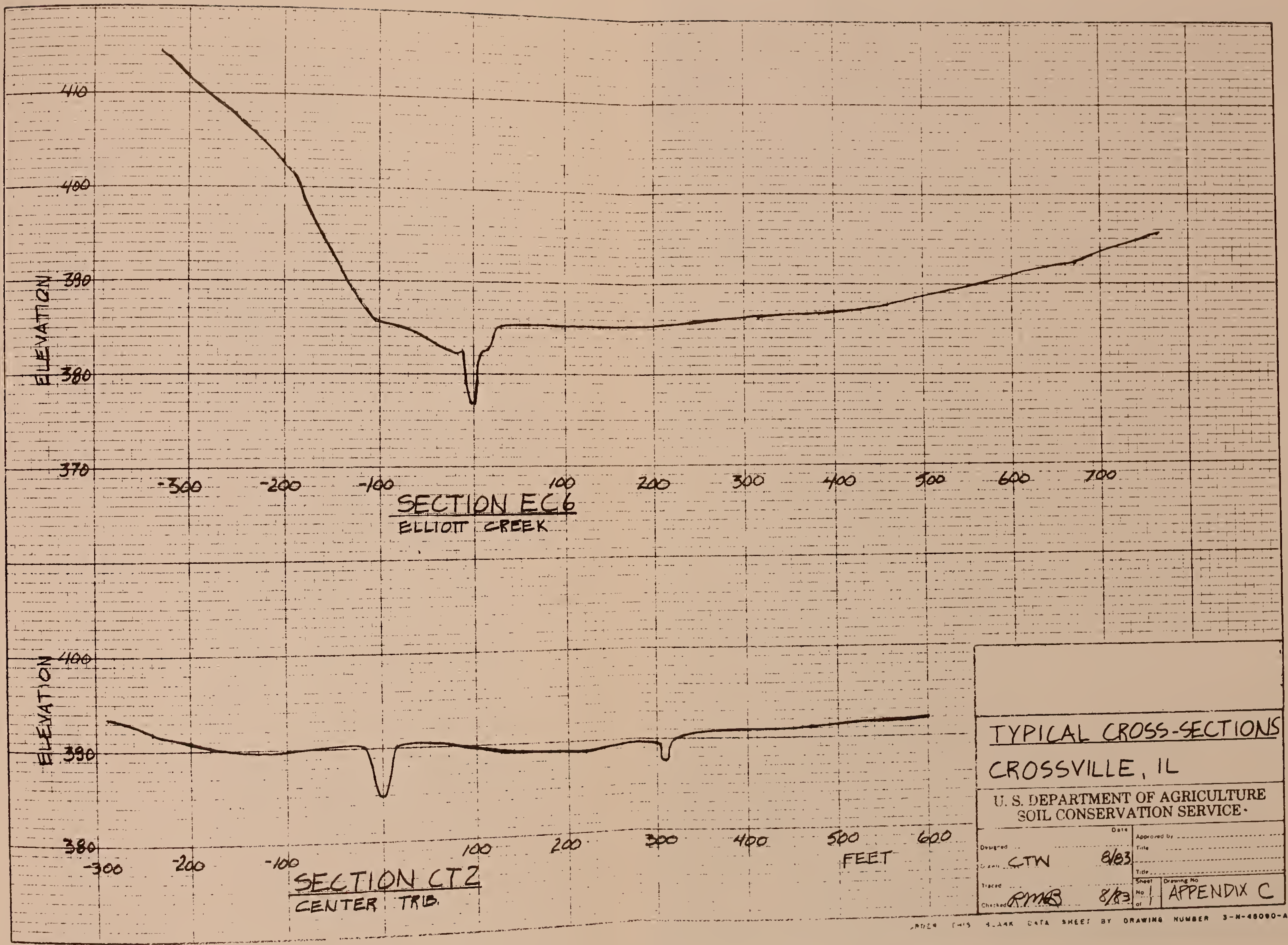
CROSSVILLE FLOODPLAIN MANAGEMENT STUDY
WHITE COUNTY, ILLINOIS
NORTH EAST TRIB OF ELLIOTT CREEK

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Drawn J. MAYES 5-83
Traced CTR 6-83
Checked RMB 6/83
Sheet 1 of 1
APPENDIX B

SHEET 3


CT 1
CT 2
HAMILL STREET
CT 3
MORELL STREET
CT 3A
CT 4
PENN CENTRAL RAIL ROAD
CT 4A
HWY 1
CT 5
LIMIT OF STUDY
ELEVATION, FEET
390
380
CHANNEL BOTTOM
0+00
5+00
10+00
15+00
20+00
25+00
30+00
STATIONING FROM MOUTH, FEET
CENTER TRIB
NT 1
NT 2
RAWLINSON
NT 3
N. STATE ST. BRIDGE
NT 4
400
390
380
370
CHANNEL BOTTOM
LIMIT OF STUDY
0+00
5+00
10+00
15+00
20+00
25+00
30+00
35+00
40+00
STATIONING FROM MOUTH, FEET
NORTH TRIB
LEGEND
500 YR. FLOOD PROFILE
100 YR. FLOOD PROFILE
50. YR FLOOD PROFILE
10 YR FLOOD PROFILE
CROSSVILLE FLOODPLAIN MANAGEMENT STUDY
WHITE COUNTY, ILLINOIS
CENTER TRIB & NORTH TRIB of ELLIOTT CREEK
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Date
Designed
Drawn CTR 11/83
Approved by
Title
Title
Traced
Checked RMB 11/83
Sheet No. 1 of 1
Drawing No
APPENDIX B
SHEET 2


ELEVATION
410
400
390
380
370
-300
-200
-100
100
200
300
400
500
600
700
SECTION EC6
ELLIOTT CREEK
ELEVATION
400
390
380
-300
-200
-100
100
200
300
400
500
600
FEET
SECTION CT2
CENTER TRIB.
TYPICAL CROSS-SECTIONS
CROSSVILLE, IL
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Drawn CTW 8/83
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Date
Approved by
Title
Sheet No. 1
Drawing No. APPENDIX C
ORDER THIS BLANK DATA SHEET BY DRAWING NUMBER 3-N-48090-A

APPENDIX D

CROSSVILLE, ILLINOIS

REFERENCE MARKS

NAME	ELEVATION	DESCRIPTION
TBM D	398.52	Nail in power pole at NE corner of Rt. 1 and 14.
TBM C	399.18	Nail in power pole at intersection of S. State St. and Rt. 1 and 14.
TBM 1-A	397.67	Chiseled square in concrete sidewalk between south concrete pillars of Penn. Central Railroad trestle over west Main St. in Crossville.
TBM 2-A	390.35	Chiseled "X" on manhole rim at centerline of Hamill St. and Winkler St. in Crossville.
TBM 3-A	400.58	Chiseled "X" on bolt at top of fire hydrant 40 ft. north and 18 ft. west of intersection of N. State St. and Winkler St.
TBM 4-A	395.34	Railroad spike in power pole at south side of dead-end street, approximately 100 ft. SE of P.I. 96 + 43.14.
TBM 5-A	409.69	Railroad spike in power pole at east 1/4 corner of sec. 15 T.4S R.10E.
TBM L	383.64	Spike in west side of power pole, west side of road on south bank of creek.
TBM 6-A	385.92	Nail in power pole near center of NE1/4 of sec. 15 T.4S. R.10E.
TBM 7-A	375.09	Chiseled square on NE corner of east guardrail on bridge over Elliott Creek (ECS1).
TBM 8-A	382.27	Chiseled "X" on north end of 12" R.C.P. under field entrance 44 ft. northwest of PI 179 + 39.95 on section ECS1.
TBM 9-A	399.05	Nail in corner of fence post, 15 ft. southwest of 200 + 86 near section EC1.

APPENDIX E-1

BUILDINGS SUBJECT TO FLOODING

Tabulation of Building Numbers and Elevations, along with Water Surface Elevations by Frequency

ELLIOTT CREEK AND TRIBUTARIES

Crossville, Illinois

			BUILDING ELEVATION		FLOODWATER ELEVATION		
STREAM IDENT.	STATION	BUILDING NUMBER	FIRST FLOOR	LOW ENTRY	10 Year 10% Chance	100 Year 1% Chance	500 Year 0.2% Chance
Elliott	24350	S1	392.0	391.5	390.8	391.7	392.1
Creek	24350	S3	392.0	391.5	390.8	391.7	392.1
	25955	S6	393.7	393.7	393.7	394.5	395.0
	25945	S6A	394.9	394.9	393.7	394.5	395.0
	25990	S7	394.2	394.2	393.8	394.6	395.1
	26185	S9	394.7	394.7	394.1	395.0	395.5
	26300	S10	395.1	395.1	394.5	395.2	395.7
	26140	S24	395.1	395.1	394.0	395.0	395.4
	26455	S34	396.1	396.1	395.4	396.3	396.5
	26425	S35	396.1	396.1	395.4	396.3	396.5
	27160	S36	397.0	397.0	396.1	396.8	397.1
	27160	S36A	395.0	395.0	396.1	396.8	397.1
	27610	S37	400.3	396.4	397.1	397.6	397.8
	27190	S42	396.4	396.4	396.1	396.8	397.1
	26900	S50	399.8	396.0	395.7	396.5	396.7
	26235	S61	393.6	393.6	394.3	395.1	395.6
	24115	C76	389.8	389.8	390.7	391.4	391.8
Center	1100	C2	391.7	391.2	390.6	391.3	391.6
Tributary	1200	C6	390.0	390.0	390.8	391.4	391.7
	1200	C7	389.9	389.9	390.8	391.4	391.7
	1200	C8	391.6	391.6	390.8	391.4	391.7
	1200	C15	392.0	391.5	390.8	391.4	391.7

APPENDIX E-1

BUILDINGS SUBJECT TO FLOODING

Tabulation of Building Numbers and Elevations, along with Water Surface Elevations by Frequency

ELLIOTT CREEK AND TRIBUTARIES

Crossville, Illinois

STREAM IDENT.	STATION	BUILDING NUMBER	BUILDING ELEVATION		FLOODWATER ELEVATION		
			FIRST FLOOR	LOW ENTRY	10 Year 10% Chance	100 Year 1% Chance	500 Year 0.2% Chance
Center Tributary (cont.)	1200	C15A	392.1	391.6	390.8	391.4	391.7
	1550	C16	391.5	391.5	391.2	391.7	392.1
	1230	C17	390.0	390.0	390.9	391.4	391.7
	1555	C19	391.7	391.7	391.2	391.7	392.1
	1515	C20	391.3	391.3	391.2	391.7	392.0
	1675	C22	392.1	392.1	391.6	392.1	392.4
	1675	C23	392.1	391.6	391.6	392.1	392.4
	1675	C23A	390.7	390.7	391.6	392.1	392.4
	1700	C24	392.3	392.3	391.7	392.2	392.4
	2050	C34	393.0	393.0	393.3	393.8	394.0
	2050	C35	392.8	392.8	393.3	393.8	394.0
	2050	C36	393.7	393.7	393.3	393.8	394.0
	2300	C37A	394.5	394.5	394.2	394.9	395.2
	2150	C38	394.0	394.0	393.5	394.3	394.5
	2180	C39	393.4	393.4	393.8	394.4	394.6
	2600	C44	396.0	395.5	395.8	396.8	397.3
	2600	C45	397.9	395.5	395.8	396.8	397.3
	2600	C47	395.4	395.4	395.8	396.8	397.3
	2050	C48	393.8	393.8	393.3	393.8	394.0
	1405	C49	391.6	391.6	391.0	391.6	391.9
	1550	C50A	391.7	391.7	391.2	391.7	392.1
	2780	C63	396.0	396.0	396.9	397.7	398.1
	2780	C64	396.9	396.9	396.9	397.7	398.1

APPENDIX E-1

BUILDINGS SUBJECT TO FLOODING

Tabulation of Building Numbers and Elevations, along with Water Surface Elevations by Frequency

ELLIOTT CREEK AND TRIBUTARIES

Crossville, Illinois

			BUILDING ELEVATION		FLOODWATER ELEVATION		
STREAM IDENT.	STATION	BUILDING NUMBER	FIRST FLOOR	LOW ENTRY	10 Year 10% Chance	100 Year 1% Chance	500 Year 0.2% Chance
Center	2650	C66	396.7	396.7	396.1	397.0	397.5
Tributary	2650	C67	396.9	396.9	396.1	397.0	397.5
(cont.)	2650	C68	397.0	397.0	396.1	397.0	397.5
	2650	C69	397.2	397.2	396.1	397.0	397.5
	2570	C72	396.6	396.6	395.6	396.6	397.1
	2590	C74	397.0	397.0	395.8	396.7	397.2
North	1610	NW9A	392.3	392.3	393.0	393.6	393.8
Tributary	1400	NW19	393.4	392.9	392.3	393.0	393.3
	1050	NW22A	392.1	392.1	391.4	392.0	392.4
	1050	NW23	391.3	391.3	391.4	392.0	392.4

APPENDIX E-2

BUILDINGS SURVEYED - NOT SUBJECT TO FLOOD DAMAGE OTHER THAN YARDS

Tabulation of Addresses, Building Elevations, and Water Surface Elevations by Frequency

ELLIOTT CREEK AND TRIBUTARIES

Crossville, Illinois

STREAM IDENT.	STATION	BUILDING NUMBER	BUILDING ELEVATION		FLOODWATER ELEVATION		
			FIRST FLOOR	LOW ENTRY	10 Year 10% Chance	100 Year 1% Chance	500 Year 0.2% Chance
Elliott Creek	24275	S4	393.9	393.9	390.9	391.4	391.9
	25890	S5	398.8	398.8	393.2	394.1	394.9
	26025	S8	395.5	395.5	393.2	394.2	395.1
	26215	S23	396.0	396.0	393.8	394.7	395.4
	26100	S25	396.1	396.1	393.7	394.6	395.2
	26125	S26	398.1	398.1	393.8	394.7	395.3
	26585	S27	397.1	397.1	395.5	396.3	396.5
	26530	S28	398.8	398.8	395.5	396.3	396.5
	26550	S29	397.9	397.9	395.5	396.3	396.5
	26425	S30	400.0	400.0	395.4	396.3	396.5
	26400	S31	398.4	398.4	395.4	396.3	396.5
	26400	S32	397.5	397.5	395.4	396.3	396.5
	26400	S33	396.9	396.9	395.4	396.3	396.5
	27160	S38	397.6	397.6	396.0	396.7	397.0
	27450	S39	399.9	399.9	396.4	397.1	397.5
	27490	S40	397.5	397.5	396.5	397.2	397.5
	27440	S41	397.7	397.7	396.4	397.0	397.4
	27240	S43	398.8	398.8	396.1	396.9	397.2
	27340	S44	397.9	397.9	396.3	397.0	397.3
	25255	S44A	395.5	395.5	392.0	392.9	393.3
	25345	S45	394.8	394.8	392.2	393.2	393.5
	25435	S46	394.9	394.9	392.4	393.4	393.6
	25485	S47	395.6	395.6	392.5	393.5	393.6
	25335	S48	395.2	395.2	392.2	393.2	393.5
	25415	S49	396.1	396.1	392.4	393.4	393.6

APPENDIX E-2

BUILDINGS SURVEYED - NOT SUBJECT TO FLOOD DAMAGE OTHER THAN YARDS

Tabulation of Addresses, Building Elevations, and Water Surface Elevations by Frequency

ELLIOTT CREEK AND TRIBUTARIES

Crossville, Illinois

			BUILDING ELEVATION		FLOODWATER ELEVATION		
STREAM IDENT.	STATION	BUILDING NUMBER	FIRST FLOOR	LOW ENTRY	10 Year 10% Chance	100 Year 1% Chance	500 Year 0.2% Chance
Elliott Creek (cont.)	23820	C75	391.9	391.9	390.5	391.3	391.7
	24165	C77	392.5	392.5	390.7	391.4	391.9
	23910	C78	392.7	392.7	390.6	391.4	391.8
	24175	C80	394.0	394.0	390.7	391.4	391.9
Center Tributary	1180	C2A	392.5	392.5	390.8	391.4	391.6
	1120	C3	392.2	392.2	390.7	391.3	391.6
	1160	C4	393.9	393.9	390.8	391.4	391.6
	1130	C5	392.6	392.6	390.7	391.3	391.6
	1200	C8A	392.2	392.2	390.8	391.4	391.7
	1180	C9	392.4	392.4	390.8	391.4	391.6
	1740	C10	392.6	392.6	391.8	392.3	392.5
	1625	C10A	393.6	393.6	391.6	392.0	392.3
	740	C11	393.9	393.9	390.4	391.1	391.4
	800	C12	393.0	393.0	390.4	391.2	391.4
	820	C13	393.2	393.2	390.4	391.2	391.4
	890	C14	392.6	392.6	390.5	391.2	391.5
	1080	C15B	392.1	392.1	390.7	391.3	391.6
	1080	C15C	392.4	392.4	390.7	391.3	391.6
	1400	C18	392.6	392.6	391.0	391.6	392.0
	1535	C21	395.1	392.4	391.2	391.7	392.1
	1675	C25	392.4	392.4	391.6	392.0	392.4
	1675	C26	393.0	393.0	391.6	392.0	392.4
	1675	C27	393.4	393.4	391.6	392.0	392.4
	1675	C28	392.5	392.5	391.6	392.0	392.4

APPENDIX E-2

BUILDINGS SURVEYED - NOT SUBJECT TO FLOOD DAMAGE OTHER THAN YARDS

Tabulation of Addresses, Building Elevations, and Water Surface Elevations by Frequency

ELLIOTT CREEK AND TRIBUTARIES

Crossville, Illinois

STREAM IDENT.	STATION	BUILDING NUMBER	BUILDING ELEVATION FIRST FLOOR	BUILDING ELEVATION LOW ENTRY	FLOODWATER ELEVATION 10 Year 10% Chance	FLOODWATER ELEVATION 100 Year 1% Chance	FLOODWATER ELEVATION 500 Year 0.2% Chance
Center	1910	C29	394.7	394.7	392.1	392.5	392.8
Tributary	1885	C30	392.9	392.9	392.1	392.5	392.8
(cont.)	1885	C31	393.7	393.7	392.1	392.5	392.8
	1885	C32	393.6	393.6	392.1	392.5	392.8
	1990	C33	394.1	394.1	392.8	393.1	393.2
	2155	C37	394.6	394.6	393.7	394.3	394.5
	2215	C40	395.7	395.7	393.9	394.4	394.7
	2195	C41	396.2	394.2	393.9	394.4	394.7
	2235	C42	395.6	395.6	394.0	394.4	394.8
	2235	C43	396.1	396.1	394.0	394.4	394.8
	2405	C46	396.6	396.6	394.7	395.4	395.8
	1555	C50	393.1	393.1	391.2	391.7	392.1
	1675	C51	393.3	393.3	391.6	392.0	392.4
	1770	C52	393.6	393.6	391.9	392.3	392.6
	1815	C53	392.9	392.9	392.0	392.4	392.6
	1945	C54	394.0	394.0	392.2	392.5	392.8
	1915	C54A	394.1	394.1	392.1	392.5	392.8
	2005	C55	396.4	396.4	393.1	393.4	393.7
	2125	C56	394.7	394.7	393.6	394.2	394.4
	2200	C57	395.2	395.2	393.9	394.4	394.7
	1655	C58	393.8	393.8	391.6	392.0	392.4
	1745	C59	394.1	394.1	391.9	392.3	392.5
	1825	C60	394.0	394.0	392.0	392.4	392.6
	1885	C61	396.5	396.5	392.1	392.5	392.8

APPENDIX E-2

BUILDINGS SURVEYED - NOT SUBJECT TO FLOOD DAMAGE OTHER THAN YARDS

Tabulation of Addresses, Building Elevations, and Water Surface Elevations by Frequency

ELLIOTT CREEK AND TRIBUTARIES

Crossville, Illinois

STREAM IDENT.	STATION	BUILDING NUMBER	BUILDING ELEVATION		FLOODWATER ELEVATION		
			FIRST FLOOR	LOW ENTRY	10 Year 10% Chance	100 Year 1% Chance	500 Year 0.2% Chance
Center	1925	C62	396.2	396.2	392.2	392.5	392.8
Tributary	2590	C65	398.0	398.0	395.8	396.7	397.2
(cont.)	2590	C70	398.9	398.9	395.8	396.7	397.2
	2570	C71	398.2	398.2	395.6	396.5	397.1
	2560	C73	398.1	398.1	395.6	396.5	397.1
	2590	C74A	398.0	398.0	395.8	396.7	397.2
	1885	C89	393.8	393.8	392.1	392.5	392.8
	1905	C90	394.3	394.3	392.1	392.5	392.8
North	3310	NW1	403.9	403.9	399.2	399.7	400.2
Tributary	2180	NW2	396.3	396.3	395.6	396.1	396.3
	1750	NW3	395.9	395.9	394.2	394.5	394.8
	1750	NW4	395.8	395.8	394.2	394.5	394.8
	1735	NW5	397.3	397.3	394.1	394.5	394.7
	1710	NW6	394.8	394.8	394.1	394.4	394.7
	1630	NW7	395.6	395.6	393.0	393.6	393.8
	1630	NW8	395.6	395.6	393.0	393.6	393.8
	1610	NW9	394.8	393.9	393.0	393.6	393.8
	1600	NW10	394.6	394.6	393.0	393.5	393.7
	1500	NW13	394.7	394.7	392.8	393.4	393.5
	1500	NW14	394.5	394.5	392.8	393.4	393.5
	1430	NW15	394.5	394.5	392.2	393.0	393.3
	1430	NW16	394.0	394.0	392.2	393.0	393.3
	1360	NW17	394.2	394.2	392.0	392.6	393.2
	1160	NW20	396.4	394.2	391.6	392.1	392.5
	1100	NW22	395.5	392.7	391.5	392.0	392.5
	3470	NW24	401.4	401.4	400.0	400.4	400.7

APPENDIX F

INVESTIGATIONS AND ANALYSES

Hydrologic and Hydraulic: Channel cross sections, roads, bridges, and culverts were surveyed by the State of Illinois as part of their contribution to the study. These detailed surveys, with minor additions, were used by SCS for analyzing the hydraulic characteristics for the detailed study area.

The floodplain along the lower reach of Elliott Creek was determined using backwater elevations from Little Wabash River and available USGS maps.

Detailed topographic maps were prepared by the State of Illinois Division of Water Resources to cover the area inside Crossville corporate limits. These maps are at a scale of 1"=200' with two foot contour intervals. (one foot, supplementary contours). The SCS Computer Program for Project Formulation-Hydrology (TR20) was used to evaluate the hydrology for Elliott Creek and its tributaries (Reference 5). This is an advanced hydrologic model which can simulate the historical flood stages. This model will develop hydrographs for local drainage areas, channel routes these hydrographs and combines hydrographs. Rainfall amounts, drainage areas, hydrologic soil groups, land use and cover, times of concentration and channel and floodplain hydraulic characteristics are inputs to the model. The model developed for this study takes into account the storage characteristics of the watershed upstream of the Penn-Central Railroad tracks.

The flood discharges were coordinated in accordance with the state Flood Plain Study Review Procedure. This review was conducted by State Water Survey with certification by the State Division of Water Resources.

An analysis of the hydraulic characteristics of the creeks was carried out to provide stage estimates for floods of selected recurrence intervals

along each of the streams. The water surface elevations (stage) were established based upon the physical elements present such as the channel size and shape, the floodplain size and shape, the bridge sizes and shapes, and the Manning's roughness coefficients. The hydraulic computations were made using the SCS Hydraulic Model WSP-2 (TR61) (Reference 6). This model employs the standard step method for backwater profiles. The method involves a computational procedure which estimates total energy at each stream cross section and accounts for friction losses between sections. The bridge effects on stream hydraulics were accounted for in WSP-2 using the Bureau of Public Roads (BPR) Method (refer to "Hydraulics of Bridge Waterways"). The bridge method has been formulated by the principle of conservation of energy between the point of maximum backwater upstream from the bridge and a point downstream from the bridge at which normal stage has been established. The culverts were evaluated by the principle of conservation of energy and consideration of the depth of headwater and tailwater, the barrel shape and cross-sectional areas, the type of inlet, and shape of headwall.

The hydraulic model requires peak discharges, in addition to channel and floodplain geometry, bridge and culvert geometry, roughness coefficients and starting data. Starting elevations were computed using normal depth computations and Little Wabash River profiles. Channel sections were taken at selected locations to represent the hydraulic characteristics of the stream system. Channel roughness factors (Manning's "n" values) were assigned on the basis of field observations using the SCS procedures and U. S. Geological Water Supply Paper 1849. (Reference 8) All elevations are NGVD (National Geodetic Vertical Datum).

The floodway was determined for all studied reaches. The floodway is the channel of the stream, plus any adjacent floodplain areas that need to be

kept free of encroachment in order to carry the 100-year flood without substantial increase in flood stages. This floodway was computed on the basis of equal conveyance reduction from each side of the floodplain using the SCS Floodway Computer Program (TR-64). (Reference 7)

Economic: The economic evaluation of floodwater damages for this study was done by use of the Urban Floodwater Damage Economic Evaluation Program (URB1, Reference 14). The effects of floodwater damage were evaluated for existing land use (same as future without project) using WSP-2 rating tables, surveyed buildings including first floor elevations, low water entry points, and type of building along with damage factors based on the type of building, structure value, and contents value. The effects of floodwater damages were evaluated for future without project conditions, and the URB1 program was used to determine the effects of various alternative solutions on residential damages. Appendix E-1 lists those buildings subject to flood damage.

The Building Location Map, Appendix A, shows the surveyed buildings included in the economic evaluation. Damage evaluation for traffic interruption was based on the following assumptions: 1) Estimated traffic count at railroad underpass of 50 vehicles per hour and at the weigh station of 130 vehicles per hour with one third of these being commercial vehicles. 2) The time water would be over the road more than 0.5 feet deep was determined using TR-20 hydrographs and WSP-2 rating tables. Average time was less than 2 hours per storm event. 3) The value of each hour to the private and commercial vehicle owners was estimated to be $5 and $25 respectively. 4) The only

traffic interruptions included were along Hwy 1 at the underpass and at the weigh station. No evaluation was made of internal traffic disruption on Crossville streets.

Total estimated damages for future without project conditions are $350 annually. These damages would be reduced to $200 annually through the channel maintenance program.

It is apparent that many of the buildings in Crossville are not subject to flood damages (See Appendix E-2). However, many of these are subject to yard and garden damage along with the inconvenience of getting to and from the buildings.

It was decided that each time a yard is flooded the estimated damage is 0.3% of the property value. The estimated frequency of flooding for each yard was determined and then total damages for each property were calculated for a 100-year time period. This total was then divided by 100 to come up with the average annual damage of $1,660 for the future without project condition. A channel maintenance program for Elliott Creek upstream of the pipe bridge, Center Tributary and North Tributary would reduce these average annual damages to $1,150.

Damages to the approximately 470 acres of farmland in the 100 year floodplain were not evaluated in detail. Current land use is 100 acres of woodland and 370 acres of row crops. It is estimated that these flood damages exceed $5,500 on an annual basis. The channel maintenance program would have minimal impact on these damages because of the limited size of the existing channel and the backwater from the Little Wabash River. Enlarging the channel from the first bridge to town (16' bottom) would protect at least 50 acres of cropland from the 2-year flood but would only protect about 15 acres from the 100-year flood.

Floodproofing: The evaluation of the effects of the suggested floodproofing measures assumed the premise that temporary measures, such as sandbagging low water entry points, would be effective in excluding floodwater from a structure for up to one half foot of depth. For greater depths, structural modifications would be necessary. The businesses, garages, and sheds where structural modification is not possible or practical could easily limit content damage by raising damageable contents less than one foot above the floor. Even in the most severe cases, raising the damageable contents to two feet above the floor would put them above all but the extremely rare flood event elevations.

Terrace Evaluation: Terraces with underground outlets were evaluated as a means of reducing the flood peaks. The terrace systems were modeled using the TR-20 hydrologic model and the WSP-2 hydraulic model. Data from two actual terrace system designs in the watershed area were used to create representative stage-storage-discharge relationships for tile outlet terrace systems. These representative relationships were varied linearly by size of system to model the effects of the terraces in reducing peak discharges at a given section. The design of the terrace systems was altered slightly to maximize temporary storage which in turn maximized the flood control benefits. The terrace ridges were raised uniformly by 0.5 ft. above the standard 10-year design level with a controlled overflow (emergency spillway) at the 10-year design level. The controlled overflow area would be located near the end of the storage area to minimize potential damage from the infrequent overflows. The volume of storage was computed using a template based on the narrow ridge terrace concept.

An incremental analysis was done to evaluate the reduction in peaks for North Tributary by adding systems beginning at the upper end of the north tributary watershed. The results of this analysis are included as Table F-1. The effect of terraces in the watersheds of both North and Center Tributaries on Elliott Creek peak discharges is also included in Table F-1.

The placement of terraces in the watershed model was dictated by areas already terraced, areas planned for terraces, and by field inspection of areas where terraces would be applicable. No systems were included on the two tributaries to the southeast after field inspection revealed no apparently suitable sites.

Economic benefits of the reduced peak discharges due to terracing are summarized in Table F-2. The "with project" average annual damages given for North Tributary are for the fully terraced (260 ac.) increment.

Table F-1
Percent (%) Reduction in Peak Discharges
for Terraces on North and Center Tributaries

Increment	% of D.A. Terraced	% Reduction in Peak 2 yr.	10 yr.	100 yr. 1/
North Tributary				
100 acres	13.3	13	13	12
140 acres	18.6	18	18	17
210 acres	28.0	28	28	26
260 acres	34.7	34	34	31
lower 160 acres	21.4	24	25	22
Center Tributary				
172 acres	33.6*	10	11	12
	50.7**	47	48	49
Elliott Creek (below Crossville)	18.2	20	21	20

*at junction with Elliott Creek
**above Crossville

Table F-2
Average Annual Damages ($)
Urban Buildings

	Without Project	With Project	% Reduction
North Tributary	$ 1,150	$ 485	58.0
Center Tributary	$12,265	$ 2,585	78.9
Elliott Creek	$ 7,690	$ 7,690	0
Total	$21,105	$10,760	49.0

Average annual benefits for terraces evaluated = $10,345.

1/ These values recognize that the terraces will be overtopped but assumes no large washout during the storm event.

Erosion Inventory: A field inventory was completed to determine the present acreage of excessive eroding land, the total tons of erosion and sediment yield, and to develop alternative resource management systems effective in reducing erosion and sediment yield rates. A total of 17 sample areas, 160 acres in size, were randomly selected for the field inventory. Cropland was identified by the steering committee as the critically eroding land use in the watershed and was inventoried by field in each of the sample areas.

The inventory revealed that 6,240 acres (92%) of cropland presently had average annual erosion rates in excess of tolerable levels with erosion totaling 58,200 tons, and yield 40,500 tons of sediment annually to the local channel system. Megarills, or ephimeral gullies, contribute an additional 14,400 tons annually to the channel system.

Three alternative resource management systems were developed by the district conservationist during the inventory. Alternative #1 was designed to reduce erosion rates to tolerable levels and included 1,060 acres of contour farming, 180 acres of grassed waterways or outlets, 38 grade stabilization structures, 1,870 acres of land use change, 4,230 acres of conservation tillage (1,410 acres chisel tillage and 2,820 acres no-till), and 140 acres of conventional tillage. Total erosion was reduced 63,800 tons (88%) and sediment yield 49,000 tons (89%).

Alternative #2 was designed to reduce erosion rates to tolerable levels using less land use change, some increased intensity cropping patterns and terraces. Included was 1,360 acres of contour farming, 190 acres of grassed

waterways, or outlets, 38 grade stabilization structures, 1,650 acres of land use change, 94,500 feet of terrace and diversions, 4,450 acres of conservation tillage (1,540 acres chisel tillage and 2,910 acres no-till) and 140 acres conventional tillage. Total erosion was reduced 63,500 tons (87%) and sediment yield 49,200 tons (89%).

Alternative #3 consisted of those conservation practices the district conservationist thought most likely to be applied by landowners in the watershed. Included were 960 acres of contour farming, 160 acres of grassed waterways or outlets, 32 grade stabilization structures, 430 acres of land use change, 26,600 feet of terraces, and 5,660 acres of conservation tillage (1,870 acres chisel tillage and 3,790 acres no-tillage) and 150 acres of conventional tillage. Total erosion was reduced 59,800 tons (82%) and sediment yield 46,200 tons (84%).

The following table displays erosion and sediment yield reduction and conservation practice needs by alternative:

Table F-3 AVERAGE ANNUAL SHEET, RILL AND MEGARILL EROSION -- TONS

(Total Cropland Acreage = 6,775 acres)

Alternative	Total	Erosion Reduction	% Reduction
Present Conditions	72,600	--	--
Alternative #1	8,800	63,800	88
Alternative #2	9,100	63,500	87
Alternative #3	12,800	59,800	82

Table F-4 AVERAGE ANNUAL SEDIMENT YIELD TO LOCAL WATERCOURSES -- TONS

Alternative	Total Yield	Yield Reduction	% Reduction
Present Conditions	55,200	--	--
Alternative #1	6,200	49,000	89
Alternative #2	6,000	49,200	89
Alternative #3	9,000	46,200	84

Table F-5 CONSERVATION PRACTICE BY ALTERNATIVE

FOR CROPLAND ACREAGE REQUIRING TREATMENT - 6,240 ACRES

Conservation Practice	Unit	Present Conditions	Alt. #1	Alt. #2	Alt. #3
Contour Farming	Acre	-	1,060	1,360	960
Grassed Waterways or Outlets	Acre	-	180	190	160
Grade Stab. Str.	Each	-	38	38	32
Land Use Change	Acre	-	1,870	1,650	430
Terrace	Feet	-	-	93,100	26,600
Diversion	Feet	-	-	1,400	-
Tillage System					
Chisel	Acre	2,950	1,410	1,540	1,870
No-Till	Acre	130	2,820	2,910	3,790
Conventional	Acre	3,160	140	140	150

Geomorphic Analysis: Geomorphic analysis provided a basis for estimating the stability of the existing main stream channel and its efficiency of transporting sediment, and for predicting the effects of proposed measures on channel stability. The analysis was based on a profile of the channel of Elliott Creek constructed from surveyed cross-sections and a 7 1/2 minute quadrangle map (Reference 11) The profile data, cross-section characteristics, and other geomorphic parameters were analyzed by methods described in References 16 and 17.

Table F-6 summarizes the channel profile data for Elliott Creek. Definitions of symbols in the table area n = segment identification number; l = segment lenth; r = segment relief; g = gradient of segment; r_c = cumulative relief above base land; l_c = cumulative length above base land; e_r = relative evalation; l_r = relative length; l_d = flow length; LGI = length gradient index; r_d = relief etween downstream end of segment and watershed divide; v = valley length; s = sinuosity. Additional explanation of these terms, as well as others described below, may be found in References 16, 17, and standard geomorphology textbooks.

Table F-7 contains data derived from 6 cross-sections of Elliott Creek, and used in formultating project hydrology (References 5 and 6). Channel cross-sectional parameters, particularly top width/depth ratio, were compared to other parameters, such as gradient, sinuosity, and the fine-grained nature of the soils, and interperted through geomorphic principles. Relationships between these variables apparently depend on whether the cross-sections are located on straightened or "natural" segments of the channel. However, enough data were not available to assure a sufficient degree of statistical significance, and only preliminary inferences can be made.

The following parameters were derived from Tables F-6 and F-7:

1) index of relative maturity = 0.60

2) index of relative stability = 2.37

3) index of relative uniformity = 0.0045

4) index of work potential = 3.95

5) mean length gradient index = 176 ft.

6) mean gradient = 0.0019

7) mean sinvosity = 1.35

8) channel sediment transport

   efficiency factor = $\dfrac{1x\ (LGI/r_d)]}{nL}$ = 0.146

Geomorphic analysis suggests certain tentative conclusions concerning relationships between parameter, channel stability, and sediment loads and transport capability. Elliott Creek channel is a low energy system forced to carry a relatively high sediment load. This conclusion perhaps explains the higher than normal top width/depth ratios of channel cross-section in fine-grained sediment, and the inverse relationship between sinuosity and gradient. The channel shows little tendency to degrade its bed at alarming rates, eventhough the middle portion of the channel has been artificially straightened. However, additional channel work is not recommended without further studies to evaluate stability. Destruction of vegetative protection and rootmats in the banks of straightened portions of the channel should be especially avoided.

Sediment yields were predicted as follows:

1) sheet and rill erosion in watershed = 58,200 t/yr.

2) delivery ratio of sheet and rill to local, small water courses = 0.70, based on the local topography.

3) megarill erosion - 14,400 t/yr, based on field data and comparison to studies of similar areas.

4) local sediment yield = (0.70) (58,200) + 14,400 = 55,200 t/yr.

5) sediment yield to Little Wabash = channel sediment transport efficiency factor x local sediment yield = (0.15) (55,200) = 8,300 t/yr.

6) sediment trapped in channel and on floodplain = sediment delivered to channels - sediment delivered to Little Wabash = 55,200 = 8,300 = 46,900 t/yr.

7) accretion rate based on the estimates that 12% of watershed area is bottomland, and sediment density (aerated) = 75 lb/ft^3

(46,900 t/yr) 1,021 ac = 46 T/ac/yr.

(46 T/ac/yr) (2,000 lb/t) (1 ft3/7,5lb) (1 ac/43,560 ft^2) = 0.03 ft/yr.

Table F-6. Profile Data for Main Channel of Elliott Creek, Crossville White County, Illinois

n	elev., ft.	l, ft.	r, ft.	g	r_c, ft.	l_c, ft.	e_r	l_r	l_d, ft.	LGI, ft.	cum.% LGI	r_d, ft.	LGI/r_d	v, ft.	s=1/v
1	359.9-360	3,950	0.1	0.0000253	0	0	0.00	0.00	39,100	1	100	74.1	0.0135	1,950	2.03
2	360-360.1	3,450	0.1	0.000029	0.1	3,950	0.001	0.10	35,150	1	99.8	74	0.0135	2,200	1.57
3	360.1-360.2	3,870	0.1	0.0000258	0.2	7,400	0.003	0.19	31,700	1	99.5	73.9	0.0135	1,950	1.98
4	360.2-362.5	3,450	2.3	0.000667	0.3	11,270	0.004	0.29	27,830	19	99	73.8	0.26	2,150	1.60
5	362.5-364.5	1,200	2	0.001667	2.6	14,720	0.035	0.38	24,380	41	95	71.5	0.57	650	1.85
6	364.5-366.5	750	2	0.002667	4.6	15,920	0.06	0.41	23,180	62	85	69.5	0.89	550	1.36
7	366.5-370	1,750	3.5	0.002	6.6	16,670	0.09	0.43	22,430	45	70	67.5	0.67	1,100	1.59
8	370-374	2,750	4	0.00145	10.1	18,420	0.14	0.47	20,680	30	58	64	0.47	2,000	1.38
9	374-374.8	1,180	0.8	0.000678	14.1	21,170	0.19	0.54	17,930	12	51	60	0.2	1,000	1.18
10	374.8-376	1,050	1.2	0.001143	14.9	22,350	0.20	0.57	16,750	19	48	59.2	0.32	1,000	1.05
11	376-377	700	1	0.00143	16.1	23,400	0.22	0.60	15,700	22	44	58	0.38	650	1.08
12	377-380	1,100	3	0.000909	17.1	24,100	0.23	0.62	15,000	14	38	57	0.25	1,000	1.10
13	380-390	4,450	10	0.00225	20.1	25,200	0.27	0.64	13,900	31	35	54	0.57	4,300	1.03
14	390-400	3,000	10	0.00333	30.1	29,650	0.41	0.76	9,450	32	27	44	0.73	2,780	1.08
15	400-405	1,200	5	0.00417	40.1	32,650	0.54	0.84	6,450	27	20	34	0.79	1,100	1.09
16	405-410	1,950	5	0.00256	45.1	33,850	0.61	0.87	5,250	14	13	29	0.48	1,450	1.34
17	410-420	1,450	10	0.006897	50.1	35,800	0.68	0.92	3,300	23	10	24	0.96	1,300	1.12
18	420-430	1,500	10	0.00667	60.1	37,250	0.81	0.95	1,850	12	4	14	0.86	1,450	1.03
19	430-434	350	4	0.01143	70.1	38,750	0.95	0.99	350	4	1	4	1.00	300	1.17
20	434	0	0	0.0	74.1	39,100	1.00	1.00	0	0	0	0	-	0	-
	Totals:	39,100	74.1							410				28,800	

Table F-7 Characteristics of Cross-Sections of Elliott Creek, Crossville, White County, Illinois

Cross-Section	Top Width, ft.	Depth, Ft.	w/d	Area, $Ft.^2$	Remarks
EC-1	56	9.6	5.83	341	natural
EC-2	46	10.2	4.51	280	natural
EC-3	28	7.8	3.59	144	natural
EC-4	31	8.0	3.88	148	straightened 1935±
EC-5	19	5.8	3.28	78	straightened 1967±
EC-6	20	5.6	3.57	76	straightened 1967±